THE PHILIPPINE
JOURNAL OF SCIENCE
D. GENERAL BIOLOGY, ETHNOLOGY AND ANTHROPOLOGY

VOL. VI DECEMBER, 1911 No. 6

THE FISHERY RESOURCES OF THE PHILIPPINE ISLANDS. PART IV, MISCELLANEOUS MARINE PRODUCTS.

BY ALVIN SEALE.

(From the Ichthyological Section, Biological Laboratory, Bureau of Science, Manila, P. I.)

CONTENTS.

I. PHILIPPINE TREPANG (BÊCHE DE MER).

Trepang is a general name applied in the Philippines to all of the many species of animals belonging to the group Holothurioidea and known locally as *bêche de mer, balatan, bilate, munang, hisam,* sea cucumber, and cotton-spinner. Large quantities of these animals are gathered in the Philippines for export to China and Japan. Trepang is a staple food of all Oriental people and is an important item of export from the Philippine Islands.

Trepang in general appearance resembles pickled cucumbers. The

skin may be smooth, or covered with prickle-like teats arranged in rows or scattered over the body. In color they range from pale flesh-color to black. These animals, when dry, are hard, sausage-shaped, and appear to be altogether unpalatable and it is not until they have been cleaned, minced, and made into a most delicious soup by the skillful hand of the Chinese cook that the real value of this product of the sea is understood. *Bêche de mer* live among the white sand and coral in the sea-gardens and feed upon small sea-animals and sea-vegetation, so there is no reason why they should not rank as a delicious food product and come into general use among Europeans and Americans. I can, from experience, heartily recommend a trial of trepang soup[1] to those who delight in a dish free from the contaminations of the land, with a delicate aroma of the deep sea about it.

VARIETIES OF PHILIPPINE TREPANG.

In Manila all the large dealers in trepang are Chinese. They recognize five different varieties, as follows:

No. 1.[2]—Oē (Plate I, fig. 1). A large, uniformly black, perfectly smooth variety (*H. atra* Jæger). This species, when dry, is from 120 to 200 millimeters in length and 40 to 60 millimeters in diameter. This is regarded as the most desirable species found in the Islands and sells for the highest price, being valued at 65 to 98 centavos per kilogram wholesale, according to the size of the animal, and care in curing. I will call it the great smooth black trepang.

No. 2.—Gan Sim (Plate I, fig. 2), is a large brownish trepang, with two rows of teats on each side. The animal, when dry, is of a rather flat, oval shape, about 120 millimeters in length and 60 millimeters in width. Its back is but slightly roughened. This species is regarded as being next to the best variety, sells for 40 to 80 centavos per kilogram, and is in fair demand. We will call it the great oval brown trepang.

No. 3.—Bark Sim (Plate I, fig. 3) is the third grade of trepang and to this belongs the great mass of trepang shipped from the Islands. It includes a large variety of forms ranging in price from 35 to 70 centavos

[1] *To make trepang soup.*—Clean and wash out the trepang in cold water, slice and put them in a chopping bowl and mince fine, soak in cold water five hours then boil for one hour, add salt and pepper and a quantity of beef or chicken stock and bring to a boil. Serve hot. [Sing Fat.]

[2] I have been unable to find anyone in the Philippines who recognized or could give me any information regarding the names given to the Philippine trepang by Simmonds in his Commercial Products of the Sea, although I have repeatedly asked dealers and fishermen both in Jolo and Manila. It is possible that his so-called "bankolungen" is the gan sim, his "munang" the oē, his "telepan" the moi whar che, his "sapatos grande" the smooth white ringed bark sim, his "sapatos china" is perhaps the great convoluted bark sim, and his "lowalowan" is possibly the bark sim, called the small black wrinked trepang in the present paper.

per kilogram, the most abundant, perhaps, being small, black, slightly roughened, cylindrical in shape, and when dry about 90 millimeters long by 25 millimeters wide (Plate II, fig. 1). Another very common form of this grade is the Philippine convoluted trepang, a large, light brown species about 130 millimeters by 40 millimeters, cylindrical, with the body, when dry, thrown into deep folds (See Plate II, fig. 5). Another bark sim is a moderately roughened, cylindrical trepang of a dull yellowish-brown color and 150 by 35 millimeters in size (Plate II, fig. 3). Another is a dark brown, almost smooth form (when dry), with the back covered with small orange spots with black centers. This is a large species, 170 by 70 millimeters, and cylindrical in shape (Plate 4, fig. 4). I will call this the smooth white-ringed trepang. Another form very similar to the last I will term the rough white-ringed trepang. (Plate II, fig. 2.) This trepang is 160 by 48 millimeters in size, cylindrical, with the body decidedly tuberculate; it is rather dark brown in color with numerous white circles around the large tubercules of the sides and back. Another rather common trepang of the bark sim grade, is a small, very black form, with deep wrinkles in the body (Plate II, fig. 6). This variety when dry is cylindrical in shape and about 80 millimeters long by 20 millimeters deep. I will call it the small black-wrinkled trepang.

No. 4.—Moi Whar Che (Plate I, fig. 4). This trepang is a large, cylindrical black form, easily distinguished by the fact that the entire back is covered with numerous, very long teats which are black or reddish brown in color. This variety is quite abundant, but is regarded as fourth rate as a food product, the price being from 30 to 50 centavos per kilogram. I will term it the great prickly trepang.

No. 5.—Hong Che (Plate I, fig. 5) is the fifth grade of trepang, and resembles the last except that it is smaller and more cylindrical; the teats are more pointed and slightly longer. Its wholsale price is from 35 to 45 centavos per kilogram. Many of the young of the moi whar che are to be seen in this class, but are distingnished easily by their short teats. In size the hong che is from 50 to 90 millimeters in length by 16 to 20 millimeters in width.

There are numerous other grades among the 63 species of these animals found in the Philippines, but none are of sufficient importance or value to be recognized in trade. However, one very common form, called "yellow belly," is so abundant, especially about Mindoro, that is deserves at least to be catalogued. This form when dry is yellow-white on the belly and black on the back, about 60 millimeters in length and 25 in depth; its value is not above 12 pesos [3] per picul. It is only the great abundance of this grade that makes it worth our consideration.

All of the above grades retail in Manila for fully 30 per cent advance on the prices obtained by the fisherman.

[3] One peso is equal to 50 cents United States currency, and 1 picul is 139 pounds.

DISTRIBUTION, HABITS, GROWTH, AND PRODUCTION OF PHILIPPINE TREPANG.

The wide distribution of these apparently helpless, sedentary sea-animals is a matter of interest and astonishment to all who give the subject any thought. Twenty of the species found in the Philippines are also common to Polynesia, 16 to the Malay Archipelago, 30 to the Red Sea and the coast of Africa, while 3 extend even to the west coast of America. The majority of the recorded forms are believed to be well distributed throughout the Philippines, but are most abundant in the Sulu Archipelago. The supply for Manila comes chiefly from Tacloban, Polillo, and Ambos Camarines. They are found in water of various depths, even in very shallow water and also on reefs dry at high tide, down to 137 fathoms and even to much greater depth. Sheltered places inside the coral reefs where the bottom is of coral sand seem to be favorite haunts of the bark sim and hong che forms, while moi whar che, gan sim, and oê seem to prefer water of greater depth just at the edge of the reef. The greater number of the trepang appear to pass large quantities of sand and mud through their alimentary canals; from this sand they extract the small animals and plants on which they feed. On Arboles Reef, Gulf of Davao, Mindanao, I once noticed a large number of *Colochirus quadrangulus* Less. feeding on sea-weed which at low tide was about 75 millimeters (3 inches) under water. They were so abundant that it was scarcely possible to step without treading them down, and in one scoop of an ordinary dip net I secured 57 of them. It is probable that during the season for depositing the eggs they all seek the reefs or rocky crevices. Mitsukuri,[4] in his most interesting paper on the common Japanese trepang, writes, referring to the Island of Oki,

> The people there have for a hundred years or more been in the habit of putting up loose stone-piles in the shallow sea in order to obtain a supply of this trepang.

Nowhere in the Philippines is this devise put into practice although it doubtless would yield profitable results.

Practically nothing is known about the breeding time of the Philippine trepang and it is a subject well worth investigating. In Japan (as abstracted from the above paper), the trepang spawn in May and June, and at the end of the first year have a maximum size of 5 by 25 centimeters. They reach the adult condition at the end of the second year, but do not spawn until the end of the third; some individuals probably live two or three years after spawning. The young specimens are white and transparent, and they attach themselves to the roots of algæ, or seek rocky crevices in sheltered localities. Hence a rock pile affords a natural collecting ground for the very young as well as for the old. Japan has put some measures in force setting aside certain localities as

[4] Notes on the Habits and Life-History of *Stichopus japonicus* Selenka. *Annot. Zool. Jap.* (1903–06), 5, 1–21.

breeding reserves for trepang, upon which stone piles or dikes have been constructed, and in these places fishing for trepang is strictly forbidden. In this way the Japanese hope to conserve this valuable food supply.

There are so many natural breeding places in the Philippines along the coast and among the rocks on the shore line of the many islands, that our supply now is, and probably for years to come will be, much greater than the demand, or rather more than the fishermen under present conditions will take the trouble to dry and prepare for market.

METHODS OF FISHING FOR TREPANG.

In gathering trepang, the fisherman usually goes out at low tide wading in the shallow water, dragging a small canoe or *banca* behind him, into which he throws all the trepang he picks up; sometimes he fishes from a boat, with a long handled, one-pronged spear, with which he gathers up the trepang in water of 3 to 4 meters. In water of greater depth some fishermen dive and bring up the trepang in their hands. There are localities where small dredges undoubtedly could be used with good effect.

PREPARING TREPANG FOR MARKET.

The Filipino method of preparing trepang for the market is to boil them for a short time (from five to twenty minutes) in fresh water, after which they are split up the belly, eviscerated, and then thoroughly dried in the sun. Each variety seems to require a slightly special treatment particularly in regard to the length of time required for boiling, in order to bring out the best flavor. However, they should all be heated thoroughly throughout, and when taken out of the boiling water they should be hard and elastic, and should dry quickly like a hard boiled egg. The oê frequently is boiled only five minutes; it should be well stirred. Experience really is the only guide as to the length of time required for boiling. Sun-dried trepang are the best, and in the greatest demand, but the method of sun-drying is too slow for preparing a whole ship-load. The following method given by V. Simmonds[5] is followed in preparing large shipments of trepang.

> The first thing to do on arriving at an island where trepang is plentiful is to erect a curing house on shore. This house may be of any desired size but one 30 meters long by 15 meters wide, with sides 4 meters high, will be found convenient for preparing a ship's cargo. This structure may be built of native material such as mats, bamboo, etc., and roofed with a coconut thatch which must be put on well to keep out the rain. A small door should be left in each end of the house. Platforms for drying the trepang are then erected along one side of the entire length of the house and these should be 2 meters wide, the lower one about breast-high from the ground and the upper one 1 meter above that.

[5] The Commercial Products of the Sea. New York (1897), 111.

These are made of split pieces of bamboo or small slats. A trench 1 meter in width and a half meter deep is then dug beneath the lower platform along its entire length, for the fires. Tubs filled with salt water are placed at short intervals along the trench, with buckets near at hand for use in preventing the fire blazing up and burning the trepang or destroying the house.

The process of curing is as follows: The trepang is first caught and gutted and washed in fresh water; it is then carried into the curing house and placed on the lower platform where it is spread out about 14 centimeters (5 inches) thick, to dry. When this platform is covered with the trepang, the fires are lighted in the trench; they must constantly be kept going, day and night, and be carefully guarded. Much skill is required in properly drying the trepang as well as in boiling it, as too much heat will cause it to blister and get porous, like a sponge, whereas too little will lead to its spoiling and turning putrid within twenty-four hours after being boiled; care is requisite likewise in gutting, for if this is not properly attended to the animals will turn into a blubbery mass within a few hours after being caught. On the afternoon of the second day after the fires are lighted, they are extinguished for a short time and the trepang is shifted to the upper platform; splints of wood should be put in those not properly drying. The lower platform is then filled again with a fresh supply of trepang from the pots, and the fires are again lighted. The trepang on the lower platform should be turned frequently during the first twelve hours. After another two days the fires are again put out and the trepang on the upper platform shoved over at one end to make room for those on the lower platform, and the same proceeding repeated for the two following days, by which time (six days in all) the first day's product will be cured properly. The trepang is then taken off the upper platform and carefully examined, those not dry are put back again, and the quantity cured is stowed away in bags on shipboard or in a dry storehouse. The product soon becomes damp unless packed in air-tight casks. If held in storage for three months, it requires to be dried again for a short time in the sun.

Forty men are necessary to work a house of the above size to its greatest capacity.

UTILIZING TREPANG AS FOOD.

The chief use of trepang as food is in the form of a savory soup, as heretofore described. It is also eaten as a meat by certain natives of the Philippines, after it has been roasted. In some islands of the Busuanga group, the natives collect these animals and by irritation cause them to eject a viscous white fluid which swells up greatly when it comes in contact with sea-water and splits into numerous white threads, not unlike cotton; these threads are cooked and eaten and are regarded as a delicacy. However, as the animal frequently ejects almost all the viscera as well as the mucus, the dish probably would not appeal to Europeans or Americans.

The Chinese believe that trepang is not only a most delicious food, but that it also possesses excellent medicinal qualities.

QUANTITY AND VALUE OF EXPORTED PHILIPPINE TREPANG.

Sixty-six thousand eight hundred thirty-eight kilograms of trepang were exported from the Philippines in 1909. The export in 1910 was 120,969 kilograms, which, at the low price for third grade quality, would

be valued at 51,780 pesos. As a matter of fact much of it was first and second grade trepang so that probably the true value would more nearly approximate 75,000 pesos. According to British statistics, the Sulu Archipelago alone supplied Singapore in 1907 with trepang valued at 21,975 pesos. Singapore's total trade in trepang for that period was valued at 442,102 pesos, two-thirds of which was shipped to Hongkong. It would be much cheaper for Hongkong to buy directly from Manila; as a matter of fact, our last year's increase in export largely was due to the direct buying of Hongkong dealers.

China imports each year about 3 million kilograms of trepang, chiefly from the Malay Archipelago, Philippine Islands, and the South Pacific Islands. The export from Manila might easily be doubled without damage to the fisheries.

COMMERCIAL POSSIBILITIES IN PHILIPPINE TREPANG.

While it is true that trepang is one of the minor marine products of the Philippines, nevertheless, we should not lose sight of the fact that it is a staple and recognized article of diet with a country which has the largest population on the face of the globe, and where it finds a ready market; also, that it can be cheaply prepared, that the natural supply in the Islands is large, and that with but little care the output probably could be increased readily. Taking all these facts into consideration, it is rather a matter of astonishment that large canning companies, especially in the United States, have not awakened to the possibility of this product of the sea and added the delicious trepang soup to their list of conserved products.

A check list of Philippine holothurians appears at the end of this paper.

II. THE SHARK-FIN INDUSTRY IN THE PHILIPPINE ISLANDS.

The drying and curing of sharks' fins (Plate III, fig. 1) in the Philippines, for export to China, is one of the minor industries, requiring but little capital and yielding profitable returns. At present the business is almost entirely in the hands of Chinese merchants.

The fins of all of the numerous species of sharks found in the Islands are used, as well as some of the fins of the larger rays. The big, dorsal fin of the shark is the most desirable; this is usually of a uniform pale grayish or whitish color on both sides, and is supposed by the Chinese to contain more gelatin than any of the others, therefore it commands the highest price and is known in commerce as the "white fin." All the remaining fins, which include the ventrals, pectorals, anal, and caudal, are classed together as "black fin." The large caudal fin when uniform in color is frequently put in as "white fin." The fine white fins are selected for the making of soup, while the black fins are largely used in manufacturing a superior grade of fish glue.

METHOD OF CATCHING SHARKS.

Sharks are principally caught by the Moros, although they are captured in considerable numbers in corrals and nets throughout the Islands. The Moros usually spear them, or catch them with hook and line, using stale fish for bait. The observer can not fail to be impressed by the number and size of the sharks caught by the Samal Moros in the vicinity of Sitanki Island.

A number of Philippine sharks will take the trolling spoon, especially if it is painted red on one side; they afford very good sport. In India, sharks are captured in large nets for the sake of the oil secured from the liver; they are also used as food by the poorer classes. In the Philippines the Moros alone seem to relish shark-meat, and the manufacture of fish oil is an entirely neglected industry. If we consider the great number of sharks caught in these Islands, it is a matter of surprise to find that the making of fish-oil is not carried on in connection with the shark-fin industry, as this would very materially increase the revenue derived from each shark.

THE PREPARATION OF SHARKS' FINS.

The fins are cut from the shark as soon as possible after its capture, the thick fleshy portions of the larger fins are slit open to facilitate their drying, and they are then spread out in the sun. It requires from three to six days to dry the product depending upon the amount of sunshine. After the fins are thoroughly dry they are assorted into two grades: The white fins, or first class variety, in which are placed all the large dorsal fins; and the black fins, or second class, which includes all the small fins. They are then packed tightly in bales of about 100 kilograms each and are ready for export.

These fins are further prepared by being soaked in boiling water for a short time and the skin removed. They are then shredded into small cartilaginous rods, somewhat resembling a very fine grade of sphagetti. These are waxy white and attractive in appearance (Plate III, fig. 2).

At this stage they are either made into soup, or dried and reëxported to all parts of the world at considerably more than double the original price. To make this prepared fin into a savory and wholesome soup it is soaked in cold water one day, then placed in hot water for one hour, this causes all the rods to separate. Eggs and some chicken or beef stock, salt, pepper, and butter are added and the mixture boiled for two hours. That the above receipt produces a most delicious soup was the unanimous verdict of the staff of the Bureau of Science after testing a sample prepared by Sing Fat, a well known Chinese cook of Manila.

No great Chinese feast is complete without a dish of this soup and I believe it is worth while to call the attention of our large soup manufacturing establishments to the possibilities of this industry in the Philippines. I believe that an almost unlimited market could be found in China.

THE AMOUNT AND VALUE OF SHARK-FIN EXPORTED FROM THE PHILIPPINE ISLANDS.

Sharks' fins weighing 172,610 kilograms, valued at 85,000 pesos (42,500 dollars), were exported from Manila during the year 1910. The current price of shark-fin at Zamboanga, which is one of the centers of the trade,

is 84 centavos per kilogram for the white fin and 58 centavos for the black, therefore, it is evident that the export valuation is very low and that the real value probably would be somewhat over 100,000 pesos. The price is subject to considerable variation. In 1909 the maximum price paid for the entire yield was 2.19 pesos per kilogram including both white and black fins. Chinese merchants in Zamboanga informed me that the price for the first grade white fin sometimes reaches 6.58 pesos per kilogram, but this is unusual. Almost the entire yield of Philippine shark-fin is shipped to Singapore or Hongkong, and from these places is distributed to various parts of China.

In Manila the retail price of prepared shark-fin, as shown in Plate III, fig. 2, is from 8 to 10 pesos per kilogram.

In conclusion I wish again to call attention to the fact that the by-products of the shark fishery are entirely wasted. If, in addition to the fins, the liver was used to make fish oil, and the skin which is used for scabbards for swords was also saved, the revenue derived from each shark would be about doubled.

III. PHILIPPINE SEA TURTLES AND TORTOISE-SHELL.

VARIETIES OF PHILIPPINE MARINE TURTLES.

Sea turtles of large size find a congenial home in the warm waters of the Philippines. Abundant schools of fish supply them with plenty of food, and the hot sandy beaches of numerous, small, uninhabited islands furnish them ideal nesting places; hence, as a result of these conditions, the three recognized species of sea turtles are found throughout the Archipelago.

The marine turtles[6] are easily distinguished from all other kinds by the fact that their limbs have become completely changed into paddles, the fingers being entirely encased in a single skin, with one or two claws only projecting. They swim swiftly in the sea, but are almost helpless on the land, and if turned on their backs they can not regain their normal position.

Our most important sea turtle, popularly known as the hawksbill turtle, is *Chelone imbricata* Linn. (Plate IV, figs. 3 and 4), which supplies the tortoise-shell of commerce. It is easily recognized by the fact that it has a hooked bill (Plate IV, fig. 4) and but 13 plates on the back, which overlap like the shingles on a roof; in addition, there are 25 small plates which form the margin of the back. This turtle feeds largely on fish, crabs, and mollusks, and when full-grown is about 1 meter in length.

[6] All members of the turtle family that live in the sea are called turtles; those living on the land only are termed tortoises; and those living in fresh water terrapins.

The green turtle (*Chelone mydas* Linn.) is next in importance. (Plate IV, fig. 5.) This turtle has a straight bill (Plate IV, fig. 6), but the shields on the back, while the same in number as in the hawksbill, are perfectly smooth, evenly joined, and do not at any stage overlap. This turtle is valued chiefly as food, the shell being of no value. However, as an article of food it has from time immemorial been considered a great delicacy. This species is herbivorous, and when adult it is about 1.25 meters in length. The flesh may be cooked in any desired way, either roasted, used as soup, fricasseed, or made into stews or pies. The following method of cooking the plastron, or shell of the belly, is given by Father Labat, a Dominican monk.[7] It sounds so appetizing that I give it in full.

> The plastron or buckler is the shell of the belly, on which is left three or four inches of flesh, with all the fat, this being green, and of a very delicate flavour. The plastron is placed in the oven. It is seasoned with lemon, capsicum or cayenne, salt, pepper, cloves, and eggs beaten up. The oven ought not to be too hot, as the flesh of the turtle being tender it should be cooked slowly. While it is baking the flesh must be pierced from time to time with a wooden skewer, so that the gravy may penetrate all parts. The shell is sent up to the table and the meat carved out from it. I have never eaten anything more appetizing or better flavoured.

There are large factories in various countries that can the soup made of this turtle.

The third variety of marine turtle found in the Philippines is the loggerhead (*Thalassochelys caretta* Linn.) (Plate IV, figs. 1 and 2). This species is easily distinguished from either of the above from the fact that it has 15 shields on the back and 27 around the margin of the shell. The jaw is strongly hooked (Plate IV, fig. 2). It feeds on crabs and other crustaceans. The shell is about 1.25 meters in length when full-grown. The shell practically is of no value, being almost as thin as paper (Plate V, fig. 4), and it is only used for veneering and inlaying work. The price for which it sells is from 2 to 4 pesos per kilogram. However, the animal supplies a large portion of the turtle oil of commerce.

TORTOISE-SHELL.

During the fiscal year 1909 there were exported from the Philippines 2,040 kilograms of tortoise-shell valued at 34,942 pesos. During the year 1910 the exportation fell to 1,191 kilograms, probably owing to home buying and domestic use.

The hard, bony plates which cover the back (carapace) of the hawksbill turtle are the tortoise-shell of commerce (Plate V, fig. 1). There are 13 of these plates on the back of each turtle, 5 in the center and

[7] Simmonds, Commercial Products of the Sea. New York (1895), 367.

4 on each side. In commercial terms these are known as 8 "sides," 2 "hoofs," 1 "skull," and 2 "main" plates. The two middle side-plates are of the greatest value, being the largest and thickest. Plates 17 by 30 centimeters in diameter with a thickness of 5 to 6 millimeters are not unusual in the Philippines. In addition to these large plates, there are 25 small ones around the margin of the shell; these are known as "hoofs" and are of much less value. All of the plates together are known as a "head" of shell, and tortoise-shell nearly always is sold by the "head."

Practically all the Philippine tortoise-shell is brought into the market by native fishermen. Now, while a small number of these turtles is captured by fair means, with hook, net, spear, or trap, by far the greater number is taken when they come ashore to deposit their eggs. The fishermen are so eager to secure their prizes that as a rule they do not give the poor turtle a chance to deposit her eggs before they kill her. This short-sighted policy eventually will result in the destruction of the fisheries unless the turtles are protected during the breeding season, which is from May to August. The turtle fishermen go to small, uninhabited islands, frequently many miles from the large islands surrounding the Sulu Sea, and wait perhaps days for the turtles to come ashore to deposit their eggs. If the men are in no especial hurry they may wait until the turtle has deposited her eggs, which sometimes are 150 to 200 in number, and about the size of hens' eggs, with tough leathery shells. The fishermen then kill her before she can reach the water, and dig up the eggs which they use as food. The islands of Bancoran, Lumbucan, Arena, Cavilli, and others in the Sulu Sea, are well-known nesting places of the turtle, and it is only necessary to visit these islands to see the destruction wrought during the nesting period.

The best method of removing the tortoise-shell from the back of the turtle is to immerse the back in boiling water until the shell loosens; another method is to bury the body in the sand for eight days, when the shell becomes loosened; still another is to hold the shell over a slow fire until loosened. This latter process usually is employed. In some countries the live animal is held over the fire until the shell is loosened; it is then turned loose "to grow another shell." This method is barbarous, not only for its cruelty but also for its lack of utility, for the animal promptly dies.

WORKING AND WELDING TORTOISE-SHELL.

The methods employed in the working of tortoise-shell are quite similar to those used in working horn. As a matter of fact, horn frequently is used as an imitation of tortoise-shell. Slow heat or steam is employed, the shell becoming plastic by immersion in water of 90°C. for two minutes. When cool, it retains any shape given it while hot.

The exact technique[8] of welding tortoise-shell is as follows:

When two pieces of shell are to be joined, the two edges are beveled so that one inclined edge may lie upon the other. The edges are scraped perfectly clean, contact with the fingers or any greasy substance being carefully guarded against. A piece of paper is then bound around the overlapping edges and fastened with a string. A pair of flat tongs or pincers, something like hair-dresser's tongs, are then heated and applied to the shell, one jaw of the pincers above and the other beneath, by means of which the shell is grasped throughout the length of the seam or overlap. By holding it a short time in this position, the heat of the iron penetrates through the paper, softens the shell, and causes the two pieces to unite firmly. Sometimes two pieces of shell are united by means of boiling water as follows: The two edges are overlapped, two pieces of metal are placed along the joining, the shell is placed in a press, and the whole is immersed in boiling water. As the shell softens, the press is screwed more tightly, by which the two pieces of shell become firmly united. Owing to the fact that the shell becomes mobile with heat, it is easily molded into almost any desired shape by means of boiling water and the screw press, and even small bits of shell are utilized by being thus welded together. If too much heat is used the shell becomes blackened, consequently in many places, especially in Japan, most of the work is accomplished by hand graving, following a pattern as in scroll work. The same method is followed in Manila, where the outfit of the workman consists simply of scraper, saws, files, and a bench. Manila has two small factories employing about six men (all Chinese), where crude combs (Plate VI, figs. 1 to 6) of tortoise-shell are made. There is also a small factory in Iloilo. All the work in this place is done by hand and is of the crudest sort.

The method used to weld tortoise-shell in Japan differs in slight detail. Dr. Shigeho Tawaka of the Zoological Institute, College of Science, Imperial University of Tokyo, kindly supplies the following information.

First of all, shells which are to be welded are just dipped in water and thus moistened, the shells are then put in between two thin pieces of magnolia wood (*Magnolia hypoleuca*) and then the whole thing is moderately pressed with a pair of heated pincers which have been dipped in water an instant before operating (a hissing sound is the usual sign of these being sufficiently heated). The welding of the shell is thus completed. The reason why they use the magnolia pieces is to avoid the direct contact between the heated pincers and the shell. The temperature of the pincers is not scientifically made known, being said to be the trade secret kept among the preparators.

The appearance of tortoise-shell frequently is given to horn by brushing it over with a paste made of two parts lime to one part litharge, and a little soda lye, which is allowed to dry on. Artificial tortoise-shell is manufactured by melting gelatine and various metallic salts.

VALUES AND GRADES OF PHILIPPINE TORTOISE-SHELL.

It is very difficult to arrive at a true valuation of tortoise-shell, owing to its variations and the reluctance of the Chinese merchants, who now control the trade, to give out any facts regarding the matter, but 4 different grades are

[8] Simmonds, Commercial Products of the Sea. New York (1895), 355.

recognized. Two of the principal merchants of Zamboanga give the value of the first grade (which is not often found), as 50 pesos per kilogram while 2 principal dealers in Balabac quote the value of the first grade at 167 pesos per kilogram. These prices were quoted to customs officials. The value of the second grade is from 16 to 20 pesos per kilogram. A considerable portion of the Philippine shell falls in this grade (Plate V, figs. 1 and 2). The third grade is thinner and is valued at from 11 to 13 pesos per kilogram, while the fourth, consisting of small shell is valued at 4.16 to 8 pesos per kilogram. It usually is sold by the *catty*, which is equal to 1.30 pounds.

The value of tortoise-shell depends not only on the size and thickness of the plates, but also largely upon the coloring and marking, there being a great variation in the beautiful clouded and mottled patterns in the shell. The color most in demand at present seems to be the rather dark shell with but few light spots. Golden-colored combs, at one time greatly prized and to-day much used by ladies with blond hair, are made from the plates of the plastron or belly. The price of the shell also depends largely upon the prevailing style in ladies' hair dressing as well as upon the fashion in toilet articles. However, the demand for good tortoise-shell seems steadily to be increasing. Japan is the center of the work for oriental countries.

POSSIBILITIES OF TORTOISE-SHELL WORK IN THE PHILIPPINES.

Personally I have seen nothing in the Philippines which seems to offer so sure a return to a man with a small amount of capital, say 6,000 to 10,000 pesos, as the buying and working of tortoise-shell. The machinery required is but little. The manufactured articles would enter the United States duty free, thereby finding a ready market. The supply of shell is, on the average, about 2,000 kilograms per year, which would be sufficient to keep a small factory in operation and I have no doubt that the returns would be remunerative. The main difficulty would be to induce the Chinese middlemen to deal directly with the factory rather than with Shanghai or Singapore (the two places that take practically our total yield). A man who could buy directly from the fishermen would have a still larger profit.

CULTIVATION OF THE TORTOISE.

The cultivation of the hawksbill turtle has never been undertaken in the Philippines, but it is not improbable that it could be cultivated to advantage in much the same way as is the edible turtle (*Tryonyx japonicus* Schlegel) in Japan. It is a subject worthy of consideration not only by private individuals but by the Government. A careful study of the habits, nesting places, rate of growth, and food of the hawksbill and green turtles should be undertaken with artificial cultivation in view, and if thought practical, steps should be taken to establish turtle farming, for practical and experimental purposes.

IV. THE PHILIPPINE WINDOW-SHELL.

DESCRIPTION.

In the majority of windows in the city of Manila, the pane is of shell instead of glass. The shell used for this purpose is called *kapas* or window-shell (*Placuma placenta* Linn.).

This shell (Plate VII, fig. 2) is thin and flat with a rounded outline, and somewhat resembles a very large wafer. The entire shell including the animal is about 1 centimeter in thickness (Plate VII, fig. 1) by 14 centimeters in diameter. The left side (valve) of the shell is slightly convex, the right side is flat. The right side is easily transformed into a windowpane simply by squaring off the edges with a big pair of scissors or a crude machine such as is used for cutting plug tobacco. The shells are then framed and are ready for use. The size of shell most in demand will square 7.5 centimeters, although those that square 6.5 centimeters are also much used. The opinion prevailing among the general public regarding window-shell is that it is a slab of shell split off from some larger shell. This, needless to say, is entirely erroneous, as the window-shell is used in its natural condition, the two halves being torn apart and the edges merely trimmed. The left side of the shell is convex and hence is in but small demand. Windows made of these shells are translucent, admitting a soft light, very grateful to the eyes in a tropical country.

The windows present a most attractive appearance (see Plate IX, fig. 1) and consequently are used in some of the handsomest structures in Manila, such as the American Cathedral, the new General Hospital, and the new Young Men's Christian Association building; and while they increase considerably the beauty of this type of architecture, they are also peculiarly adapted to, and make a most attractive appearance in, buildings of the bungalow style.

DURABILITY AND STRENGTH OF THE WINDOW-SHELL.

These windows of shell last for generations. Some of the old churches of Manila have shell windows which have been exposed to the weather for over a hundred years and which are still serviceable. Shell windows are easily repaired, as a new shell is readily sprung into place when one becomes broken or worn.

The strength of these thin, wafer-like shells is something astonishing. Below is given a table showing the relative strength of window-shell as compared with plate glass 2 to 3 millimeters in thickness by actual test in the Bureau of Science.[9] It is shown by this table that window-shell is much stronger than plate glass 3 millimeters in thickness. The

[9] The tests were made by W. C. Reibling of the laboratory of inorganic and physical chemistry, Bureau of Science.

relatively poor showing of the Capiz shells probably is due to the fact that they were old and very dry; they also were somewhat smaller than those from Cavite.

Table showing the strength of window-shell compared with plate glass.

Material tested.	Average thickness.	Average weight per square cm.	Number of falls of a steel ball weighing 8.55 grams, necessary to produce failure on samples 2.54 cm. wide and supported at both ends 5 cm. apart. Height of fall.			Number of blows necessary to produce failure with 1 kg. weight with a rounded striking end falling 1 cm. high on specimen 7 by 7 cm. and supported at both ends 6 cm. apart.
			50 cm.	100 cm.	150 cm.	
	mm.	*gms.*				
Capiz shells	0.8	0.102	50, not broken	6 to 61	Two	6 to 73.
Cavite shells	1.1	0.227	do	50, not broken	50, not broken	390 to 1,500.
Glass	2		do	One		1.
Glass	3		do	do		2.

GENERAL ANATOMY OF THE WINDOW-SHELL.[10] See Plate VIII (a-l).

These shells when alive are more or less transparent and in younger specimens the functions of the animal may readily be observed through them. Old specimens are thickened and opaque.

The largest and most striking object that attracts attention upon opening a window-shell is the mantle, or pallial lobe (Plate VIII, fig. a), which lines the interior of the shell, the margin of which has numerous, fine, finger-like projections forming the pallial fringe (fig. b); the mantle usually is much pigmented. When the left valve is removed and the left pallial lobe cut away, the 4 scimitar-shaped gills or branchiæ are exposed (fig. c). Near the center of the shell is the round, hard adductor muscle (fig. d) which has been cut in order to open the shell. Directly above the muscle, surrounding the stomach, is the large, yellowish-green liver (fig. e); directly to the right of this is the large, yellow, genital lobe (fig. f); originating just above the highest point of the gills is the foot (fig. g), a long tube-like organ extending to or beyond the edge of the mouth and ending in a disk which is usually full of mud. On the opposite side of the shell is seen a structure slightly similar but much smaller and ending in a disk; this is the anal funnel (fig. h). The intestine extends up to the stomach. Near the base of the foot, between two, thin, flap-like membranes, the labial palps (fig. i), is found the small, slit-like mouth. Between the lower genital lobe and the muscle will be seen a delicate, thin-walled organ, the heart (figs. j and k), consisting of 2 auricles and 1 ventricle. The aorta, with some of its large branches, is on the top of the liver. To the left and near the muscle are the kidneys, or nephridia (fig. l); dark colored, elongate organs. By dissecting between these and the muscle, a long, curved, cartilage-like rod is exposed. This is the crystalline style: it is inclosed in a sac, the pyloric cæcum.

[10] For a detailed and accurate account of the anatomy and histology of *Placuna placenta* L. we refer the reader to the excellent work of James Hornell, F. L. S., of the Madras Fishery Bureau, in a Report to the Government of Baroda on the Marine Zoölogy of Okhamandale in Kittrawar, Part I (1909), 43-99, 5 pl.

The nervous system is similar to that of other members of this order, being composed of the following three ganglia: (1) The cerebral ganglion may be seen by folding back the labial palps; it is a large, pale, orange-colored mass halfway between the base of the palps and base of the foot. (2) The pedal ganglion is on the base of the foot in the middle on the dorsal side. (3) The parieto-splanchnic ganglion will be found on the lower front curvature of the muscle close to the extremity of the kidneys. The byssus and byssus gland are absent.

DISTRIBUTION OF THE PHILIPPINE WINDOW-SHELL.

The window-shell is widely distributed throughout the Islands in certain definite areas. A large bed exists in Manila Bay, especially in the shallow arm of the bay east of Cavite known as Bacoor Bay. It is also found at Parañaque; in fact, the entire east end of the bay from Parañaque to Cavite is a potential bed for the window-shell. Kawit is the center of activity for window-shell fishing for the Manila Bay beds. Important beds also occur at Pangolao and Talibon in Bohol, at Valladolid in Oriental Negros; in Capiz, Masbate, and Iloilo; in the Province of Pangasinan, Luzon, and in numerous localities in Mindanao. Doubtless, there are a number of other places in the Islands where this shell is found which have not been reported. Iloilo supplies large quantities of shell for the Manila market. Shells from the Province of Pangasinan seem to be uniformly thicker and more opaque than Iloilo shells, but average slightly less in size, being 112 and 107 millimeters in diameter.

In no place in the Philippines are these shells fished for the pearls which they sometimes contain, but always for the shell alone.

HABITS, CULTIVATION, AND FOOD OF THE WINDOW-SHELL MOLLUSK.

The window-shell mollusk is usually found in shallow water, but has been known to exist in a depth up to 20 fathoms. It requires a bottom of grayish or bluish mud where more or less fresh water is carried in by streams.

There is a large variety of marine life found in the Manila beds, such as large quantities of clams and edible oysters; in fact, the cultivation of the oyster and the window-shell is carried on simultaneously by a number of fishermen. The oyster beds are staked off by their respective owners, and when fishing for window-shell or oysters outside of their claims, all the small and half-grown window-shell oysters are collected and planted on their oyster farms and kept there until they are mature. The young shells can not be sold as they are not large enough for windows. The adults keep the claim well supplied with spat.

The owners of these claims club together and hire a watchman, who is stationed in a house built over the water near the claims.

The yield of the Cavite beds is estimated at 14,000 adult shells for a good week's fishing. However, the fishing is intermittent, depending upon the demand and also upon the owner's need of ready cash. The shells are fished entirely at low tide in water of 1 meter or less in depth; the fishermen feel for them

either with their toes or their hands, just as the fancy strikes them. Adult shells are rather scarce on the public fishing grounds of these beds. I secured but 35 in one hour of fishing, but in ten minutes an owner of one of the planted beds secured 100 adult shells for me. These measured 118 to 135 millimeters in their greatest diameter.

The shell matures in three years. At the end of the first year it is 62 to 83 centimeters in its largest diameter. The sexes are separate, the eggs being fertilized in the water. The mature ova have a decided resemblance to the form (in outline) of the mature shell, while the spermatozoa have globular-shaped heads and extremely long tails, fully 10 to 15 times the length of the head. It is a comparatively easy matter to fertilize the ripe ova under artificial conditions by taking the ripe spermatozoa of the male in sea-water or normal salt solution.

The artificial fertilization and cultivation of this important commercial mollusk is well worth our careful consideration, and it is to be hoped that with the opening of the salt-water aquarium and fish hatcheries having running salt water, that the study of the life and cultivation of this shell will be made with great care and detail.

The food of the window-shell mollusk consists of small marine organisms, chiefly diatoms, which it collects from the water. The window-shell mollusk apparently does not move about, but lies flat on the mud on its convex, left side. The foot, instead of being a means of locomotion, is used to keep the mud from the gills and other organs.

QUANTITY OF SHELL AVAILABLE AND PRICES DEMANDED.

The supply of this shell in the Philippines is so large that at no place has it been found necessary to resort to diving for it, as is done in India, as plenty of shell is secured by wading in water less than 1 meter in depth and feeling about with the toes.

There are no laws regulating the gathering of window-shells, and so far as we have been able to ascertain there are no municipal ordinances relating to them.

It is estimated that there are 5,000,000 of these window-shells used each year in the City of Manila alone. A single lumber company of this city in 1910 used 1,500,000. The demand is increasing.

The price depends upon the size. Shells that will square 63 millimeters (2.5 inches) sell for 3 to 7 pesos (1.50 to 3.50 dollars) per thousand; while the large ones which square 7.5 centimeters (3 inches) sell for 8 to 10 pesos (4 to 5 dollars) per thousand. One window-shell fisherman explained to me that he had three prices for the first-grade shells. These were valued at 8 pesos per thousand to the Filipino, 10 pesos per thousand to the Spaniard, and 12 pesos per thousand to the American.

The Chinese traders do not hesitate to ask the amateur buyer 15 pesos per thousand. The shells usually are sold in large baskets, each holding 10,000 pieces.

The window-shell is not exported to any extent, the only shipment for last year being 1,458 kilograms sent from Iloilo to New York. However, it is expected that when the builders of bungalows in the United States, especially in California, recognize how much stronger, cheaper, and more attractive these shell windows are than the same thickness of glass, there will be a brisk demand for them in that country.[11]

HOW WINDOW-SHELL IS USED.

Shell windows are made of narrow strips of wood usually 13 to 18 millimeters wide and 13 millimeters thick, or they may be any size desired. These strips are grooved on two sides and notched every 6.0 or 7.5 centimeters as the case may be, to receive the cross stick which also is notched; thus a solid square frame is formed for each shell. After these are put together the entire square is set in a solid frame to fit the window or door. (Plate IX.)

The following uses are also suggested for the shell:

Screens.—(Plate IX, fig. 2.) These shells make a most attractive and useful screen, made up either in three divisions in the usual form of the Japanese screen, or else in a single division like the Spanish screen.

Lights for verandas.—(Plate I, figs. 1, 2, and 3.) These shells make a most durable and desirable light for open verandas, as they lend themselves to a great diversity of forms, the shell being easily trimmed to fit into any form of opening. The old-fashioned lantern shape is a popular form for these lights.

Old mission shade lights (Plate X, fig. 3) are most attractive and serviceable; they are usually made up with hard-wood frames and large window-shells.

Conservatory windows.—These shells would be found most desirable by the owners of hot-houses or conservatories in countries where hail is prevalent or where the direct rays of the sun are too strong; they admit a soft light with a fair amount of heat, and the expense as compared to that resulting from breakage and painting or frosting of glass would be almost nothing.

Fronts to kitchen cabinets.—These window-shells would make up into most attractive fronts for kitchen cabinets, being easily kept clean and not liable to breakage.

A dozen other uses might be suggested for window-shells. We can most highly recommend them for almost any purpose to which opaque glass would ordinarily be applied, and I feel confident that, when their cheapness and utility are recognized in the United States, they will be exported in larger quantities.

V. PHILIPPINE SHELLS USED IN THE MANUFACTURE OF PEARL BUTTONS.

In addition to the pearl-oyster shells, which are exported from the Philippines in large quantities,[12] there are three varieties of shells found in these Islands and used in the manufacture of pearl buttons. These

[11] Names of Philippine dealers from whom window-shells may be obtained in quantity, can be obtained by applying to the Bureau of Science.

[12] See *This Journal, Sec. D* (1910), 5, 87 to 101 (with 6 plates).

are the great top shell (*Trochus niloticus* Linn.), the green snail (*Turbo marmoratus* Linn.), and the chambered nautilus (*Nautilus pompilius* Linn.).

THE GREAT TOP SHELL.

The great top shell (*Trochus niloticus* Linn.) (Plate XI, figs. 1 to 4) known locally as the lock, conic shell, trochus, *susong-dalaga*, or *samong*, is a large, conical, top-shaped shell, found in abundance in many islands of the Philippine Archipelago. Aside from the true pearl oyster, this shell is the one in greatest demand for manufacturing buttons. As a matter of fact, owing to its cheapness, it is frequently made into buttons in preference to employing the pearl oyster. The great top shell when mature is from 10 to 15 centimeters in diameter and a trifle less in height; it has many close whorls, the largest of which flares decidedly. The shell is marked with radiating or zigzag bands of red, violet, or brown; the aperture is oblique and has a spiral operculum. An adult shell 10 centimeters in diameter weights 330 grams.

The great top shell is usually found at low tide near the outer edge of coral reefs or under large rocks, and while small quantities may be encountered on almost any coral reef in the Archipelago, they are especially abundant in the vicinity of Sitanki, along the coast of Pangasinan, and Ambos Camarines, Luzon, and on the northern coast of Palawan, the eastern coast of Samar, and in the vicinity of Masbate. There are also numerous places on the coasts of Mindoro where they are abundant. I noticed a number of these shells washed up on the beach on the eastern side of the Gulf of Davao.

The soft portion of the great top shell is regarded by the Filipinos as a very fine article of food and, as a matter of fact, this species of mollusk is more sought after for its meat than for its shell. One proof of this is in the numerous piles of empty shells to be found on the beach in localities near the ocean. It is usually noticed that they have been placed on the fire, in order to cook the animal, after which it is easily removed from the shell. Of course, shells treated in this manner are spoiled so far as their commercial value is concerned. The proper way to remove the animal is to place the shell in hot water, as the shell is in no wise injured by this treatment.

So far as my experience shows, the great top shell is always more or less solitary and while five or six are frequently found under one large stone they never occur in beds or in great numbers over a given limited area.

The average annual export of this shell from the Philippines during the past four years has been about 350,000 kilograms valued at about 60,000 pesos. The price fluctuates greatly. For a considerable period the standard price was 7.50 pesos per picul for middle grade shells. The Manila

button factory, in 1910, was paying from 10 to 22 centavos per kilogram, depending on the grade. A small quantity of shell sent to the United States was sold for about 22 centavos per kilogram (5 cents gold per pound). Japanese button factories offered to buy, in large quantities, half-grown shells for 28 pesos per picul of 137.5 pounds. During May the price for great top shell in Zamboanga was 18 pesos per picul. During the past few weeks the price has fallen to 12 pesos.

The establishment of a second button factory in Manila, together with the evident desire on the part of American button factories to secure Manila shell, no doubt, are responsible for the increase in the price. The result will certainly be greatly beneficial to the trade as it will stimulate the gathering of these shells and the native fishermen will soon learn that it is more profitable to bring them to market than to destroy them by fire in order to extract the animal for food.

The one objectionable feature which must soon be taken into consideration is the desire of the Japanese buyers to secure the young, half-grown shells. It is very evident that if the young shells are taken it will not be long before there are none left to propagate. However, this is a condition that may easily be remedied by legislation. An adequate export duty on great top shells of less than 9 centimeters (3.5 inches) should be imposed at the earliest possible date.

No careful study has been made in the Philippines of the reproduction, habits, rate of growth, food, or the possibilities of artificial cultivation of this commercially important shell.

THE GREEN SNAIL SHELL.

The green snail shell (*Turbo marmoratus* Linn.) (Plate XII, figs. 1 to 4) known locally as turbo, sea snail, *lalong*, or *bulolo*, is a large, heavy, turban-shaped shell, found throughout the Philippine Archipelago, and largely used in the manufacture of buttons. It is not in as great demand as the great top shell, as it is considerably harder to work, and of less desirable color, having an opalescent instead of a pure white luster.

The green snail is the largest of the turbo family, sometimes reaching a diameter of 20 centimeters. The usual size is about 16 centimeters; the whorls are few, more or less knobbed; the body whorl is the largest; the aperture is nearly round.

The color of the shell is a rich green, mottled or spotted with brown and white. The very old shells lose much of the brown color, and show continuous bands of white following the whorls. When the rough outer layer is removed they are of a beautiful, opaline mother-of-pearl color inside and out.

In addition to being made into buttons they are also a favorite shell for cabinets, spoons, and drinking horns. The royal family of Scandinavia from time immemorial have had these shells studded with gems, mounted with silver, and formed into royal drinking cups.

The animal is highly esteemed as food by the Filipinos and is eaten in Japan also, where it is made into *chop suey*.

The green snail is found in the greatest abundance at the edges of coral reefs and in water several fathoms deep. It is also to be encountered along rocky shores under large boulders. The small islands in the vicinity of Cebú yield a considerable quantity. It is also fairly abundant along the coast of Negros and Masbate. The northern coast of Palawan also yields a large supply.

About 100,000 kilograms of the green snail shell are exported from the Philippines annually. The price paid to the fishermen ranges from 7.50 to 11 pesos per picul of 63.25 kilos.

As in the case of the great top shell, very little is known of the life history, habits, reproduction, or the possibilities of artificial cultivation of this shell in the Philippines.

THE CHAMBERED NAUTILUS.

The chambered nautilus (*Nautilus pompilius* Linn.) (Plate X, fig. 4) is so well known that a description is unnecessary. It is world-wide in distribution and is an inhabitant of water of from 300 to 350 fathoms in depth. China seems to be the only country that manufactures this shell into buttons, consequently its export from the Philippines is practically limited to that country.

The chambered nautilus is obtained in large numbers along the southern coast of the Island of Negros, sometimes as many as 3,000 nautilus shells being gathered in this region during one season. They are frequently caught in fish traps and are sold as a sort of "by-product" at 10 centavos each, although when brought into market the very fine, large specimens sell for much more. In many countries these shells are fashioned into spoons, vases, and pearl ornaments. A practical as well as an ornamental use has been made of these shells by the author, who has them mounted on red coralline, set in a solid base of red cement and with an electric globe fitted to the inside of the shell. This makes a most satisfactory reading lamp. (Plate X, fig. 4.) In Paris these shells are used for making the finest grades of cameos, and ornamental objects of pearl. They are among the most striking common shells in all museum cabinets. In New York City dealers charge from 2.50 to 5 dollars each for fine, large shells. Unfortunately the New York market is limited.

However, there is an increasing demand for these shells for the purpose of export, and some fishermen are found who give their entire time to catching nautilus. Ordinary bamboo fish-traps with funnel-shaped entrances are used. These are baited with crab and lowered into deep water, in a day or two they are drawn up and the nautilus removed. The Filipinos eat the flesh to a limited extent.

SUGGESTIONS FOR ESTABLISHING BUTTON FACTORIES IN THE PHILIPPINES.

Judging from the numerous letters of inquiry received by the ichthyological section of the Bureau of Science from various parts of the world regarding the establishment of button factories in the Philippines, this

is a subject of sufficient interest to warrant giving the following suggestions:

Location of factory.—Manila, Cebu, Iloilo, or Zamboanga would be a good place for the establishment of a button factory. The cost of renting a suitable building for a factory in either of these places would not exceed 50 dollars per month. A building would cost somewhat more than a similar structure in the country or coastwise districts in the eastern United States.

Labor.—The laborers would be Filipinos. They are found quite satisfactory by the Manila button factory, the pay in this factory being from 5 to 10 pesos per month, ten-hour days.

Power.—Steam or gasoline power would probably be found most satisfactory, although in all the places mentioned, except Zamboanga, electric power could be obtained. Wood as fuel is quite out of the question; coal costs from 10 to 14 pesos per ton in Manila. At Zamboanga water-power might be secured. Gasoline in Manila sells at from 4.50 to 5.00 pesos per 10 gallons; petroleum costs 1.40 pesos per tin of 5 gallons.

Taxation.—A manufacturer's license, costing 2.40 pesos, is required, and the internal revenue tax is one-third of 1 per cent of the gross receipts, payable quarterly.

Amount of shell available.—The amount of shell available for button making is about 450,000 kilograms of great top and green snail shell and 300,000 kilograms of pearl shell, making a total of about 750,000 kilograms (1,675,000 pounds) of shell per year.

Bleaching shell for button making.—A large portion of the button trade is with the Chinese and they require a very white button, consequently a bleach of some sort is necessary. The following method, given by Robert R. Williams of the laboratory of organic chemistry, Bureau of Science, is effective and cheap.

"Many processes are in existence for the bleaching of ivory, horn, and shell for ornamental or other purposes. When chemicals are used those having a solvent or oxidizing action on the organic matters in the horn or shell are chosen. Nowadays the most commonly used agent is hydrogen peroxide which may be had very reasonably in Europe and America. It is not feasible to use it at a distance from the factories making this chemical because of the deterioration in transit. Therefore it is more practicable to use a metallic peroxide and generate the hydrogen peroxide when needed. Barium or sodium peroxide may best be used, preferably the latter. The following process has been tested on shell buttons and found satisfactory. The buttons are first immersed in fuming sulphuric acid for ten to fifteen minutes. The acid is then drained off and may be used repeatedly if kept in well stoppered bottles. The buttons are then rinsed three times with water and covered with a 5 per cent solution of oxalic acid. Ordinarily 1 liter of buttons will require 1 liter of solution, though more is necessary for large or dark-colored buttons than for small or light ones. The oxalic acid solution should be kept ice cold if possible or at least below 20° C. Commercial sodium peroxide is now added in small quantities with constant stirring till the solution is alkaline to litmus paper. About 40 to 45 grams will be required per liter according to the purity of the chemicals. A very little of the 5 per cent oxalic acid solution is now added till, after stirring, the solution reacts acid to litmus. It is important that the solution be acid, but a large excess of acid is to be avoided.

"The buttons are allowed to lie in this solution for 24 to 72 hours according to their size and color. Bleaching proceeds better and more rapidly if the buttons are exposed to direct sunlight while lying in the liquor. This can be done in colorless glass jars which, if possible, should be tightly stoppered.

"The buttons after removal from the bleach liquor may be washed with water containing a little hydrochloric acid. This removes the encrustation from the outside and brings out the luster. After washing again with water they are ready for the further processes of manufacture.

"It will be found that buttons can be bleached effectively by this means and that the strength of the shell is increased by the deposition of calcium oxalate in the interior."

VI. PRECIOUS CORAL.

A small spray of true precious coral (*Corallium* sp.) was found on the beach of the Gulf of Davao, Mindanao, directly in front of the small station called Vigas. This specimen resembled very closely a species of Japanese precious coral (*C. japonicum* Kishinouye).

As it is not improbable that considerable quantities of precious coral eventually may be discovered in the Islands, it seems worth while to give a short description of this article of commerce, and to describe the methods employed in coral fisheries.

DESCRIPTION OF PRECIOUS CORAL.

The precious coral of commerce in its natural state closely resembles a small shrub, or the branch of a tree from which the leaves have been removed. Each stem and twig of this coral shrub has a hard central axis, or skeleton. Outside of this and similar to the bark on a plant is the thin soft covering or skin, which is easily rubbed off when fresh and is friable when dry. There are numerous small holes in the "skin" through which minute, flower-like animals project when the coral is alive; these are the coral animals (zoöids); each of them has 8 small arms or tentacles around its mouth, with which it gathers food. All of these zoöids are connected by a vascular system inside of the skin.

The hard part or skeleton is the valuable portion of the coral. It is made up of fused spicules consisting of carbonate of calcium with a small amount of silica and magnesia. The structure is concentric with radiating lines. The entire skeleton is very hard and so compact that no pores can be seen in a cross-section without the aid of a lens. This furnishes an easy test for distinguishing the precious coral from the numerous varieties of no value.

In color these corals range from white or delicate pink to dark red. Precious corals reproduce sexually, and by budding. The reproductive organs are internal and attached to the faces of the mesenteries; they shed their contents within the body where fertilization takes place. The precious corals are believed to be viviparous. Colonies are sometimes composed entirely of males, sometimes entirely of females, frequently all on one branch are males, while all on another branch of the same colony are females. Occasionally both sexes are combined in one animal, forming a hermaphrodite. The eggs contain a considerable amount of yolk and when hatched the larval forms are free swimming and may move a fair distance before they settle and become fixed.

The food of the precious corals consists of living organisms; they have been known to eat the powdered flesh of fishes.

VARIETIES AND DISTRIBUTION OF PRECIOUS CORALS.

The best known species of precious coral is *Corallium nobilis* Pallas, more generally known under its synonym of *C. rubrum* Linn. This species is found in the Mediterranean Sea off the northern coast of Africa, also off the coast of

Tunis, Sardinia, Italy, Corsica, and at the Cape Verde Islands. Eight species of precious coral have been described from Japan. These are *Corallium japonicum* Kishinouye, *C. elatius* Ridley, *C. boshuensis* Kishinouye, *C. sulcatum* Kishinouye, *C. pusillum* Kishinouye, *C. inutile* Kishinouye, *C. confusum* Moroff, and *C. konojoi* Kishinouye. Two species, *C. johnsoni* (Gray) and *C. maderense* (Johnson), are found in Madeira. *C. stylasteroides* (Ridley) occurs in Mauritius, *C. regina* (Hickson) is found in Timor, and *C. secundum* (Dana) has been found at Banda, Ki Islands and in the Hawaiian Islands. This constitutes the entire list of established species of precious corals known to the present time.

The vertical distribution of these corals in the sea varies from 5 to 500 or more fathoms. They are found attached to rocks, dead shells, or dead coral; some species seem to prefer overhanging, submarine cliffs.

In general the vertical distribution of the Japanese species ranges from 50 to 180 meters, while in the Mediterranean fisheries the work of obtaining the coral is usually carried on in waters of much greater depth.

FISHING FOR PRECIOUS CORAL.

Fishing for precious coral is almost always carried on by means of various sorts of dredges. In Japan the dredge consists of a rectangular bag net about 1.5 meters wide and 1 meter high, with a 13 centimeters mesh, this is fastened to a frame of bamboo, tufts of old netting are fastened to the lower edge of the net and at the sides. These collect many broken coral branches. The coral fishing boats are allowed to drift over the banks with the sails at half mast. The net is allowed to touch the bottom and proceeds with a jerking motion. When the fishermen think they have secured or fastened to coral they pull up the net.

The dredge used in the Mediterranean coral fisheries is of wood in the shape of a large cross with a heavy stone attached to the extremity of the lower arm and with coarse, twine bags of large mesh and with numerous tangles of frayed ropes attached to the anterior arms. Numerous variations of this, as well as ordinary tangles, are also used.

USES AND VALUE OF PRECIOUS CORAL.

The chief use of precious coral is in the manufacture of coral beads and ornaments. It is first sorted into different grades, of which there are several recognized in commerce; it is then cut into suitable pieces and all necessary holes are drilled in it. It is then filed into any shape desired, and engraved. Next it is polished with pumice stone and water, followed by a polish of very fine chalk and water. Oil is never used on coral.

The value of precious coral depends upon its color, form, and quantity. A string of large uniform beads may be bought in Italy for 20 pesos, while a string of beads of similar size but of the best quality will cost 400 pesos. Japanese precious coral in its native state sells for from 100 to 500 pesos per kilogram, and the best Mediterranean sells for twice these amounts.

The export value of coral from Japan is about 500,000 pesos per year.

THE CULTURE OF CORAL.

The culture of precious corals has not received the careful scientific attention that it should.

C. nobile has been kept alive for some time in aquaria, and if it were planted under natural conditions possibly it could be grown with profit. Careful experimenting along this line might lead to useful and valuable information.

LITERATURE ON PRECIOUS CORAL.

KISHINOUYE, K. Notes on the Natural History of Corals. *Journ. Imp. Fisheries Bur.* (1904), 14, 1-32, (13 plates).

KITAHARA, T. On the Coral Fisheries of Japan. *Journ. Imp. Fisheries Bur.* (1904), 13, 1-14 (5 plates).

THOMPSON and HENDERSON. Report on the Alcynarian Corals Collected by the Investigator. *Pub. Indian Mus.* (906), pt. I, 120.[13]

WRIGHT and STUDER. Challenger Report (1889), 31, 185.

JOHNSON, J. Y. Notes on the Corallidae of Madeira with Descriptions of two New Species. *Proc. Zool. Soc.* (1899), 57.

RIDLEY, S. O. On the Arrangement of the *Corallidæ*, with Descriptions of new or rare Species. *Proc. Zool. Soc.* (1882), 221.

DANA, J. D. United States Exploring Expedition. Zoöphytes. Phil., (1846), 8, 641.

LACAZE-DUTHIERS. Histoire Naturelle du corail. Paris (1864).

MOROFF. On a New Species of coral from Sagami Bay, Japan. *Zool. Jahrb.* Syst., (1902), 17, 404.

BLUE CORAL.

In numerous localities throughout the Philippine Archipelago a fine quantity of blue coral, *Heliopora cærulea* Linn., is found in considerable quantities, usually in water of from 2 to 10 fathoms depth.

This coral is a beautiful, permanent, cerulean blue in color. It takes a fine polish and is found in large heavy masses. No doubt it could be used in jewelry and ornamental work. No amount of polishing, however, will entirely obliterate the pores. I have collected this coral at Jolo, and at Butuan, Mindanao, on the eastern coast of Samar, and on the northern coast of Palawan. No use is made of it at the present time, but as a body for broaches, bracelets, etc., it would be very beautiful or as a background for pearls it would, in my judgment, be unsurpassed.

RED ORGAN-PIPE CORAL.

The red organ-pipe coral (*Tubipora* spp.) is very common throughout the Philippines. It has no especial value, its only use apparently being for cabinet specimens. It is a shallow-water form. I have seen large blocks of it used with other corals in the construction of a wharf.

REEF CORALS.

The common reef corals comprising a great variety of genera and species, which have as yet never been identified, are used largely in the building of roads throughout the Islands. They are employed to a limited extent in the manufacture of lime.

BLACK CORAL.

The so-called black coral (*Antipatharia* sp.) is very common in the Philippines. Fine specimens several meters in length and from 5 to 15 millimeters in diameter are common throughout the Jolo Archipelago. It is also found in larger quantities in the Gulf of Davao, Mindanao and near Cebu. It is usually secured in water of from 10 to 20 fathoms.

The U. S. S. *Albatross* dredged large quantities of this "insulated cable wire" as it was called by the sailors and this term, indeed, is fairly descriptive of the body of this coral; however, the branches are very numerous and give the small corals a decidedly shrub-like appearance.

[13] This report includes a complete bibliography relating to corals.

This coral is used chiefly for making canes, as it is easily straightened or bent into any desired shape by immersion in hot water for a short time. It takes a most beautiful jet-black polish and could doubtless be used in the manufacture of coral beads and rosaries. A cane of this coral nicely prepared and polished can be bought for from 5 to 10 pesos. The raw material has very little value at present.

VII. EDIBLE SEAWEEDS OF THE PHILIPPINES.[14]

In connection with the series of articles on minor marine products, it has been thought advisable to include what is known regarding the edible seaweeds, with the hope that the publication of the meager data available may stimulate interest in the subject. Below is given a list of the species known to be used for food, and it is confidently expected that eventually it will be greatly extended as data on the subject become available. Very little seems to have been published on the subject. The determinations have kindly been made by Dr. M. A. Howe, of the New York Botanical Garden. The list is for the most part based on a collection made by Eugenio Fénix of the Bureau of Science, in Union Province, Luzon, supplemented by some local observations in and about Manila.

In most parts of the Philippines, along the seashore, various species of marine algæ or seaweeds are found, although in this Archipelago as in most tropical countries, these are not found in masses, or in such great quantities as is the case with many forms in temperate regions, at least in shallow waters.

The first impression on studying Philippine algæ is that the number of species is very limited, but intensive collecting has brought to light a considerable number and, doubtless, as botanical exploration progresses, the list of Philippine algæ will be greatly increased. In some regions the marine algæ play no small part in the economy of the natives, a considerable number being used for food, thus entering into the local commerce.

At the present time a large percentage of our material is unclassified. Doubtless very many of our species are used for food, but collectors have given this phase of the subject comparatively little attention, so that the data on the utilization of local marine algæ are very fragmentary.

Seaweeds are used for food both raw, in the form of salads, and cooked sometimes with vegetables, such as tomatoes, and sometimes with the addition of sugar, forming the dish, popular among the natives, known to the Tagalogs as *gulaman*. It is probable that in Manila, at least, a large part of the *gulaman* is made from prepared seaweeds imported by the Chinese, although the local product is almost always to be found in the markets. In Manila various species of algæ are known as *gulaman*, but the most important appear to be *Aghardiella* sp. (*Fucus gulaman* Blanco), and *Gracillaria confervoides* (L.) Grev.

[14] Data supplied by E. D. Merrill, botanist, Bureau of Science.

Aghardhiella sp. (*Fucus gulaman* Blanco). This species is common in Manila Bay and is universally known to the Tagalogs as *gulaman*. It is probably the most generally used species in Manila, and during certain seasons is almost always to be found in the native markets.

Chaetomorpha crassa (Ag.) Kütz. Known in Union Province as *cauat-cauat*, and locally used for food.

Codium tenue Kütz. Known in Union Province as *pupu-lo;* edible.

Enteromorpha intestinalis L. This green alga is abundant in brackish water about the mouths of streams, and is eaten by the natives to some extent.

Eucheuma spinosum (L.) J. Ag. Known in Union Province as *rupruppuuc;* edible.

Gracillaria confervoides (L.) Grev. Abundant in Manila Bay at certain seasons, locally known as *gulaman*, and sold in the native markets of Manila.

Gracillaria crassa Harv. Used for food in Union Province; known to the Ilocanos as *susueldot-baybay.*

Gracillaria eucheumoides Harv. Known in Union Province as *canot-canot;* edible.

Gracillaria lichenoides (L.) Grev. Known in Union Province as *guraman;* edible. The above four species are allied to a Japanese species largely used in the manufacture of agar-agar.[15]

Halymenia formosa Harv. Known in Union Province as *gamet;* there used for food. An allied species found in Manila Bay, native name unknown, is doubtless also edible.

Liagora cheyneana Harv. Known in Union Province as *baris-baris;* edible.

Sargassum siliquosum J. Ag. Known in Union Province as *aragan*, there used for food. Widely distributed in the Philippines, as are several other species of the genus, all of which are doubtless utilized to a greater or less extent as food.

VIII. THE PREPARATION OF ISINGLASS IN THE PHILIPPINES.

The preparation of isinglass is an industry that could be carried on easily in the Philippines, but so far as I have been able to ascertain, it has never been inaugurated.

Isinglass is the purest form of commercial gelatin known; it is prepared from the "sounds" or air-bladders of certain fishes.

The preparation is very simple and requires no outlay of capital. The exact method of procedure is as follows:

Remove the air bladders (also called "maw", "swim bladder") from the fishes soon after they are caught, slit them open and wash thoroughly, take off any thin membranes which envelop them. Then expose to the air to stiffen. If oily, wash in lime water, then in fresh water and dry. They should be put to dry on "flakes" or nets so the air will have free access to all parts. It is sometimes desirable to give slight pressure in which case they may be dried between sheets of paper, or flat driers, like botanical specimens. When thoroughly dry they are put up in convenient packages and are ready for market.

[15] The well known seaweed-isinglass, or *agar-agar* of Japan, is made from an alga of the genus *Gelidium*. This genus has not yet been reported from the Philippines.

USES OF ISINGLASS.

Probably the chief use of isinglass is in fining liquors of various sorts, especially the best grades of wine. It is also used in the preparation of creams and jellies, in stiffening fabrics, and in lustering ribbons. Isinglass is also used in the manufacture of court plaster, artificial pearls, diamond cement, and imitation glass.

It is true that owing to the expense of securing pure fish isinglass, agar-agar prepared from seaweed, is used largely as a substitute. However, there is no question that pure, fish isinglass is more desirable and gives better results in almost all cases than the vegetable product.

FISHES FROM WHICH ISINGLASS IS SECURED.

The best grade of isinglass is secured from the sturgeon and is put up in Russia. In the Malay Archipelago a very fair grade of isinglass is secured from the fishes called thread-fin and from certain species of catfish and croakers. In the Philippines, a profitable source of isinglass could be found in the thread-fin, *Polydactylus plebeius* (Brouss.), called *mamali* in Tagalog, and *tatik* in Moro. It is a very common fish in the Manila markets, and ranges in length from 35 to 50 centimeters. The common catfish (*Netuma nasuta* Bl.), called *kanduli* in Tagalog, which is very abundant, especially in Laguna de Bay, also supplies a good grade of isinglass. In addition, there are several species of croakers, (*Otolithes argenteus* Kuhl & Van Hasselt), (*Otolithes leuciscus* Gunth.), and *Johnius belengeri* C. & V.), and at least two species of *Umbrina,* from all of which isinglass can be secured. The above are all common market-fish and *it has been estimated that the isinglass thrown away from them is greater in value than the price secured by the fisherman for the entire fish.*

VALUE OF ISINGLASS.

The current value of isinglass quoted from a late trade journal is as follows:

Russian isinglass, 2.75 to 3 dollars per pound; American isinglass, 0.73 to 0.75 dollar per pound; 14,000 pounds were imported into New York during the month of April, 1911.

There seems to be no local demand for this product, but, owing to the recent tariff regulation, it would enter the United States duty free; consequently, it could be exported from the Philippines with profit.

IX. PREPARING SKINS OF AQUATIC ANIMALS FOR LEATHER.

CAYMAN OR CROCODILE SKIN.

(*Crocodilus porosus* Schneider and *C. palustris* Lesson.)

For commercial purposes, skins of the medium-sized cayman, of about 3 meters (9 feet) length, are the most desirable as they are easier to tan, and make the best leather. The skin should be cut along the middle line of the belly from the chin to the tip of the tail and carefully removed

from the animal soon after its death. Fine salt in sufficient quantity should then be rubbed thoroughly into the raw side of the skin. It is then rolled compactly and placed in a dry place to cure; occasional examination should be made to see if it is curing properly. When thoroughly cured the skin is ready for tanning.

To tan, it is first soaked in a tub of clear fresh water from two to six days—depending on the size of the skin,—a 3-meter skin requires about five days. It is then placed in a rather weak solution of lime and water which should be increased in strength daily for about ten days. The wet skin is now placed on a smooth beam, raw side out, and all the fat or flesh rubbed or shaved off. It is then placed in a thick mixture of bran and water and allowed to soak for one day—this is to neutralize the alkali of the lime. During all of the above processes through the solutions it is better if the skin be agitated occasionally so that all parts receive sufficient treatment. The hide is then washed and immersed in a tank of tanning extract. Any of the native tans may be used, or oak bark, gambia, or sumac liquid of 4 per cent strength, and stronger liquid is added each day until the strength has reached 20 per cent at the end of eighteen days. The length of time will vary according to the size of the skin, strength of the solution, or the color desired. The hide is then hung up to dry and harden. It is then shaved and cleaned again so as to leave it of the desired thickness. If black, red, brown, or green shades of color are desired the skin is put into a bath of wood and aniline dyes, for about three-quarters of an hour. It is then stretched out and nailed to a board or wide frame for drying. When dry it is rubbed briskly over an iron or wooden beam to make it flexible.[15] The skin is then ready for use. The price paid for prepared skins is from 2 to 4 pesos per 20 lineal centimeters.

So far as I have been able to learn no serious attempt has been made to prepare the Philippine crocodile skin for leather. It is an experiment well worth trying, as the cayman is notoriously abundant in many streams of the Philippines.

WATER-SNAKE SKINS.

(*Lapemis hardwickii* Gray, *Chersydrus granulatus* Schneider, and other species.)

There are great numbers of water snakes in the Philippines. I have seen more than one hundred brought in with one haul of an ordinary fish sein on the Malate beach. It is quite probable that a good industry could be built up in tanning the skins of these snakes for leather. Many of them are finely marked and would make attractive belts, card cases, and ornamental objects. Considerable quantities of snake-skin leather are used in France. The following is the method of preparation:

The skins are removed from the animals and soaked for ten days in a strong solution of sulphate of zinc. They are then fleshed, scraped, washed by hand, and placed in a bath containing 100 parts water, 10 parts borax, 100 parts boracic acid, 25 parts tartaric acid, and 25 parts saturated solution of precipitated alumina. They remain in this bath one day and are then transferred to bath No. 2 containing 1000 parts water, 25 parts phosphate of zinc, 25 parts benzoate of aluminium, 50 parts glycerine, 20 parts alcohol. The skins are

[15] *Report U. S. Fish Comm.* (1902), 350.

left one day in this solution, then they are placed in the first bath again for one day, then back into the second for another day, this alternating of baths being continued for five or six days, by which time the tanning is complete. The skins are then dried, lightly staked, and finished off.

PREPARING SHARK SKIN.

Shark skin is used for a great many purposes, especially for sword grips, knife and sword sheaths, for polishing wood and ivory, and for covering small ornamental objects, such as jewel boxes or card cases. A manufacturer in Paris has made a big reputation by tanning the skin of the Malabar shark into morocco leather.

Some very beautifully marked sharks are found in the Philippines such as *Chiloscyllium indicum* (Gm.), *Stegostoma tigrinum* Linn., *Scyllium capense* Mull. & Hen., and *S. marmoratum* Gray & Hard. Their skins could be made into excellent leather.

To tan shark skins, the skins are (if hard) first soaked in water for four or five days; they then are placed in a solution of lime and water, as in the case of the crocodile skins; they remain in this solution from two to six days, and are then washed free of lime, and soaked in bran water for a day or so: they are then fleshed, or shaved, and immersed in an alum solution composed of 0.5 kilogram of alum and 0.1 kilogram of salt to 4 liters of water; they remain in this solution two or three days, with occasional stirrings. On removal they are dried and are ready for manufacturing.

To prepare shark's skin for the use of cabinet-makers it is merely cleaned and not tanned, the hard dry skin is soaked in lukewarm water for three or four days, shaved on the flesh side, and then dried. This skin will outwear many sheets of sand-paper of equal size.

We are indebted to Chas. H. Stevenson's valuable paper regarding methods of tanning, for much of the above information.[17]

X. A CHECK LIST OF PHILIPPINE HOLOTHURIANS.

1. **Cucumaria conjungens** Semper.

General color brownish. Habitat: Mariveles, Luzon. In shallow water. Length 20–25 millimeters.

2. **Cucumaria longipeda** Semper.

Color dull gray. Habitat: Bohol, Pandanon. In water of 30 fathoms. Length 20 millimeters.

3. **Cucumaria citrea** Semper.

Color orange-yellow. Habitat: Bohol. In 8 fathoms. Length 15–20 millimeters.

4. **Cucumaria versicolor** Semper.

General color olive-green. Habitat: Bohol. In water of 6 to 10 fathoms. Length 6–7 centimeters.

5. **Cucumaria maculata** Semper.

Habitat: Bohol. In water of 10 fathoms. Length 4.5 centimeters.

[17] *Report U. S. Fish Comm.* (1902), 283.

6. **Cucumaria mirabilis** Théel.
Habitat: Cebu, at the depth of 100 fathoms.

7. **Cucumaria canescens** Semper.
Habitat: Bohol. In water from 6 to 30 fathoms. Length 1.5–3 centimeters.

8. **Mülleria nobilis** Sel.
General color dusky. Habitat: Bohol. In shallow water.

9. **Mülleria mauritiana** Quoy & Gaim.
Habitat: Philippines. In shallow water.

10. **Mülleria fecanora** Jæger.
General color dirty yellowish. Habitat: Philippines. In shallow water up to 6 fathoms.

11. **Psolus complanatus** Semper.
General color grayish. Habitat: Zamboanga. In shallow water. Length 22 millimeters.

12. **Psolus boholensis** Semper.
Upper portion gray, lighter below. Habitat: Bohol. In water from 6 to 17 fathoms. Length 15 millimeters.

13. **Psolus boholensis pandanensis** Semper.
Habitat: Bohol at Pandanon. In water of 30 fathoms.

14. **Thyone villosa** Semper.
General color yellowish-brown. Habitat: Philippines. In water of 10 fathoms. Length 20–30 millimeters

15. **Thyone rigida** Semper.
General color grayish brown. Habitat: Bohol. In 10 fathoms.

16. **Thyonidium cebuense** Semper.
General color brownish gray. Habitat: Cebú. In 10 fathoms. Length 30–35 millimeters.

17. **Echinocucumis adversaria** Semper.
General color grayish. Habitat: Bohol. In 30 fathoms. Length 8–10 millimeters.

18. **Haplodactyla molpadioides** Semper.
General color pale-violet or lavender. Five branching papillæ around the anal pore. Habitat: Bohol, Cebú. In 13 to 20 fathoms.

19. **Haplodactyla molpadioides pellucida** Selenka.
Habitat: Cebú. Shallow water.

20. **Chirodota rigida** Semper.
Color light brown with whitish dots. Habitat: Bohol.

21. **Chirodota incongrua** Semper.
Sixteen tentacles, each with 18 to 20 digits. Habitat: Camiguin Island. Shallow water.

22. **Chirodota dubia** Semper.
Tentacles 18, each with 18 to 20 digits. Habitat: Camiguin Island. Shallow water.

23. **Chirodota variabilis** Semper.
Tentacles 17 or 18, each with 20 to 24 digits. Habitat: Mariveles, Luzon.

24. **Chirodota panaensis** Semper.
Habitat: Panay. Shallow water.

25. **Synapta dubia** Semper.
Habitat: Bohol. In water from 6 to 10 fathoms.

26. **Synapta pseudo-digitata** Semper.
Habitat: Bohol. In water of 15 fathoms.

27. **Synapta molesta** Semper.
Habitat: Philippines. In shallow water.

28. **Synapta reticulata** Semper.
Habitat: Philippines. In water of 8 fathoms.

29. **Synapta indivisa** Semper.
Tentacles 13, each with about 20 very long slender digits. Habitat: Zamboanga.

30. **Synapta nigra** Semper.
Digits of tentacles united by web at base. Habitat: Bohol. In shallow water.

31. **Synapta grisea** Semper.
Color in life greenish-gray, arranged in spots and bands, the ground color being a dirty light-green. Habitat: Bohol. In water from 4 to 6 fathoms.

32. **Synapta glabra** Semper.
Color dark yellowish-brown above, yellowish below. Habitat: Cebú, Bohol. Length 500 millimeters. Found in water from 4 to 6 fathoms.

33. **Synapta innominata** Ludwig.
Habitat: Manila Bay.

34. **Synapta recta** Semper.
Thirteen tentacles, with very short digits. Habitat: Bohol. In water of 6 to 8 fathoms.

35. **Synapta gracilis** Semper.
General color whitish with slight wash of yellowish-brown. Habitat: Manila Bay.

36. **Synapta beselii** Jæger.
Color in life greenish. Habitat: Cebú reefs.

37. **Synapta similis** Semper.
Pinkish-white, with some brown anteriorly. Habitat: Bohol. In shallow water.

38. **Ocnus pygmæus** Semper.
Upper color greenish, the underparts yellowish-brown. Habitat: Bohol. In water of 9 fathoms. Length 10 millimeters.

39. **Ocnus imbricatus** Semper.
General color yellowish-brown, lighter below. Habitat: Bohol. In water of 8 to 15 fathoms. Length 35–40 millimeters.

40. **Colochirus cœruleus** Semper.
General color pinkish and green with markings of yellowish. Habitat: Bohol. In water of 10 fathoms. Length 18–20 centimeters.

41. **Colochirus viridis** Semper.
General color sea-green. Habitat: Zamboanga, Mindanao. In shallow water.

42. **Colochirus cucumis** Semper.
Habitat: Bohol. In 6 fathoms. Length 3 centimeters.

43. **Colochirus anceps** Selenka.

General color orange, the feet red. Habitat: Bohol. Shallow water up to 10 fathoms. Length 8–10 centimeters.

44. **Colochirus cylindricus** Semper.

Habitat: Bohol. In water of 10 fathoms. Length 5 centimeters.

45. **Colochirus tuberculosus** Quoy & Gaim.

Habitat: Bohol. In shallow water and up to 10 fathoms.

46. **Colochirus quadrangularis** Less.

Habitat: Bohol. In shallow water and up to 10 fathoms.

47. **Stichopus variegatus** Semper.

Yellowish-gray with markings of gray and brown. Habitat: Philippines. In shallow water up to 10 fathoms.

48. **Stichopus naso** Semper.

General color yellowish-gray. Habitat: Bohol. In 10 to 15 fathoms.

49. **Holothuria marmorata** Jæger.

Auburn above, with some large spots or bands of yellowish-white; yellowish below. Scattered over the sides of the body are violet spots on a yellowish-white area. The deposits in the body wall are X-shaped, or oval with central incisions on each side. Habitat: Bohol. In shallow water.

50. **Holothuria tenuissima** Semper.

Pedicels all over the body. The deposits consist of incomplete rosettes, or slightly branched rods. Habitat: Bohol, in 15 fathoms of water.

51. **Holothuria similis** Semper.

Fine papillæ all over the body. Habitat: Bohol, in 10 to 15 fathoms of water.

52. **Holothuria erinæus** Semper.

Color dark-brown or blackish, lighter below; pedicels a light yellowish-brown. The rods bear a few spines on their sides, their ends are slightly branched or perforated. Habitat: Bohol and Luzon, in shallow water.

53. **Holothuria gräffei** Semper.

Ventral pedicels in three distinct longitudinal series. The dorsal papillæ large. The deposits consist of tables, rosettes, and irregular branched plates. Habitat: Luzon.

54. **Holothuria pulchella** Selenka.

The ventral pedicels are more crowded than the dorsal papillæ. The spire of the table consisting of a reduced almost annular disk, with 12 teeth on the top. Habitat: Philippine Islands, in shallow water.

55. **Holothuria pervicax** Selenka.

Color in alcohol grayish-brown, with some darker cross bands on the back. The pedicels and papillæ are about the same size. The ventral surface is more crowded. The tables are not well developed, the spire being short and terminating in but 4 teeth; disks small, rounded, smooth or slightly uneven on the margins. Rods small, elongate, and uneven on the margins, or with holes on the sides. Habitat: Philippine Islands.

56. **Holothuria atra** Jæger.

Dorsal papillæ and ventral pedicels of nearly equal size. Disks forming simple rings; often with small hole at the base of each vertical rod. The spire terminating in 8 horizontal and 4 vertical teeth. The plates are evenly rounded, or

undulated on margins, often with X-shaped branches. Habitat: Philippine Islands, in shallow water.

57. **Holothuria edulis** Lesson.

Color a dark reddish-brown, light gray on sides and belly, a minute, dark ring around the base of the pedicels. The dorsal papillæ are very minute and more scattered than the ventral pedicels. Disk of the tables reduced to a small ring more narrow than the top of the spire, which, when seen from above, presents a small circular hole surrounded by 4 prominences, each with 4 or 5 teeth. Habitat: Bohol, in 10 to 20 fathoms of water.

58. **Holothuria monacaria** Lesson.

Color yellowish white, speckled with brown or greenish-brown on the back. The young specimens are auburn, with the ventral surface white. The papillæ paler. The dorsal papillæ are arranged in 4 indistinct longitudinal rows. The rounded disks of the tables have a central hole surrounded by 4 to 12 holes. The spire terminates in 12 teeth. Habitat: Zamboanga, in shallow water. Length 110 millimeters.

59. **Holothuria vagabunda** Selenka.

The color varies from a dark brown to a reddish-brown. The tables have small disks; the spires terminate in 8 to 10 teeth placed around a nearly circular aperture at their top; buttons with 6 holes; the dorsal pedicels alone have supporting rods, these are spinous and taper towards the ends. Habitat: Philippines, in shallow water.

60. **Holothuria fusco-cinerea** Jæger.

Color dusky-red, with some darker transverse bands on the back. The tables never seem to attain the usual length of the spire, nor to have the usual number of transverse beams. Habitat: Bohol, in 6 to 10 fathoms of water. Length 222 millimeters.

61. **Holothuria immobilis** Semper.

Color on dorsal surface brown, with some darker spots or bands, belly dirty yellowish-white inclined to brown anteriorly. Tentacles 26; ventral surface with pedicels, the dorsal surface with papillæ. The disks of the tables spinous; the buttons irregularly formed, with about six holes. Habitat: Bohol, in from 6 to 8 fathoms of water.

62. **Holothuria coluber** Semper.

The dorsal surface with papillae; ventral surface with pedicels. The tables have long spire of 4 rods, and 3 to 5 transverse beams. Habitat: Bohol, in 6 to 8 fathoms.

63. **Holothuria impatiens** Forskål.

Color in alcohol, light brown, inclined to violet. Integuments rough, the smooth disks of the tables are pierced with 9 holes of equal size; buttons symmetrical with 6 holes. Habitat: Philippines, in 6 fathoms.

64. **Holothuria scabra** Jæger.

The color varies with different localities. Some are cinereous with almost black transverse bands, with a few small whitish bands or spots on the back, the belly being yellowish-white, and each papilla being surrounded with a small dark circle. In other localities they are paler and punctated with a few large dark spots, but are without the dark bands. The tables are solid, with smooth, well developed disks, spires of usual shape with 12 to 16 teeth. The buttons have 6 holes, are symmetrical, and for the most part knotted. Habitat: Bohol, in shallow water. Length 170 millimeters.

65. **Holothuria albiventer** Semper.

Belly dirty gray, finely punctated; papillæ whitish; back dusky; tentacles yellowish-white. The tables have large rounded disk with numerous small holes. The spire is formed by 6 or 10 rods, its large rounded top is covered with small teeth; buttons oval. Habitat: Bohol, in shallow water.

66. **Holothuria squamifera** Semper.

Papillæ scale-like. Tables small, numerous; spire long narrow, with 5 transverse beams; buttons with from 6 to 12 holes. Habitat: Philippines.

THE MOST IMPORTANT WORKS RELATING TO TREPANG.

SEMPER, C. Reisen im Archipel der Philippinen (1868), 1, pt. 2.

THÉEL, H. Report of the Scientific Results of the Exploring Voyage of H. M. S. Challenger, 1873–76. Zoology (1882), 4, pt. 3; (1886), 14, pt. 2.

PEARSONS, J. Report on the *Holothurioidæ* of the Gulf of Manaar. In Ceylon Pearl Oyster Report. *Roy. Soc. Supp. Rep.* No. 5 (1903), 1, 181.

SIMMONDS, V. Commercial Products of the Sea. New York (1879).

MITSUKURI, K. Notes on the Habits and Life-History of *Stichopus japonicus* Selenka, *Annot. Zool. Jap.* (1903–1906), 5, 1.

MITSUKURI, K. On Changes which are found with Advancing Age in the Calcareous Deposits of Stichopus japonicus, Selenka. *Ibid.* (1897), 1, 31.

SLUITER, C. Fauna des Java-Meeres. *Nat. Tidj. v. Ned. Indie* (1887), 47.

SELENKA, E. *Zeit. f. wiss. Zool.* (1867), 17, 291.

BELL, F. J. Zoological Collection of H. M. S. 'Alert.' (1884).

EDWARDS, C. L. Variation, Development and Growth in Holothuria floridana Pourtalès and in Holothuria atra Jäger. *Biometrika* (1908), 6, 236–301.

ILLUSTRATIONS.

PLATE I. PHILIPPINE TREPANG.

FIG. 1. The oe.
2. The gan sim.
3. The bark sim.
4. The moi whar che.
5. The hong che.

PLATE II. DIFFERENT VARIETIES OF "BARK SIM."

(Third grade Philippine Trepang.)

FIG. 1. Small black trepang.
2. White ringed trepang.
3. Yellowish brown trepang.
4. Dark brown trepang.
5. Convoluted trepang.
6. Small convoluted trepang.

PLATE III. PHILIPPINE SHARK-FIN.

FIG. 1. Dried shark-fin prepared for export.
2. The fin prepared for soup.

PLATE IV. THREE VARIETIES OF SEA TURTLES.

FIG. 1. The loggerhead (*Thalassochelys caretta* Linn.).
2. Head of the loggerhead turtle.
3. The hawksbill turtle (*Chelone imbricata* Linn.).
4. Head of hawksbill turtle.
5. The green turtle (*Chelone mydas* Linn.).
6. Head of green turtle.

PLATE V. PHILIPPINE TORTOISE-SHELL.

FIG. 1. Plate from the hawksbill turtle.
2. Section showing thickness of the above plate.
3. Plate from the green turtle.
4. Section showing thickness of the green turtle shell.

PLATE VI. COMBS MADE IN MANILA FROM PHILIPPINE TORTOISE-SHELL.

PLATE VII. PHILIPPINE WINDOW-SHELL.

FIG. 1. Cross-section of shell near the adductor muscle showing actual width of shell including the animal.
2. Window shell, with growth of crustacean eggs near one margin.
3. Window shell opened and with the mantle of left side removed showing the organs in place.

PLATE VIII. ANATOMY OF THE WINDOW-SHELL MOLLUSK. *a*, Mantle; *b*, pallial fringe; *c*, gills; *d*, adductor muscle; *e*, liver; *f*, genital lobe; *g*, food; *h*, anal funnel; *i*, labial palps; *j*, ventricle; *k*, auricle; *l*, kidneys.

PLATE IX. UTILIZING WINDOW SHELL.

FIG. 1. Shell window in the new General Hospital, Manila.
2. Screen made of window shell and red *narra* wood.

PLATE X. SHELL LAMPS.

FIG. 1. Small porch-light made from window shell.
2. Lantern light made from window shell.
3. Reading lamp made of wood and window shell.
4. The nautilus reading light. *a*, Base of red cement; *b*, stem of red coralline; *c*, shade of chambered nautilus; *d*, electric wire to bulb which is hidden in nautilus shell.

PLATE XI. THE TOP SHELL.

FIG. 1. Top shell (*Trochus niloticus* Linn.). Showing cuts for buttons in the partition walls.
2. Side view of *Trochus niloticus* Linn.
3. *Trochus niloticus* cut through the vertical plane.
4. Top view of *Trochus niloticus* Linn.

PLATE XII. THE TURBON SHELL.

FIG. 1. Turbon shell (*Turbo marmoratus* Linn.)
2. Turbon shell (young).
3. Turbon shell cut on a vertical plane.
4. Side view of *Turbo marmoratus* Linn.

Fig. 1.

Fig. 2.

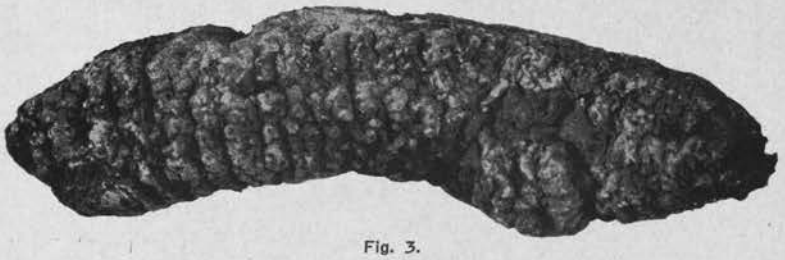


Fig. 3.

Fig. 4.

Fig. 5.

PLATE I.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

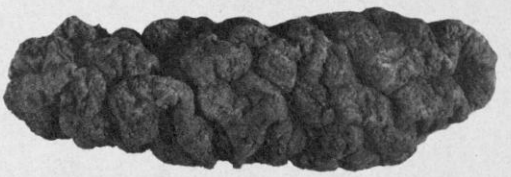


Fig. 5.

Fig. 6.

PLATE II.

Fig. 1.

Fig. 2.

PLATE III.

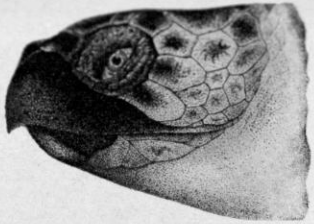


Fig. 2.

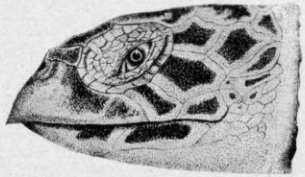


Fig. 4.

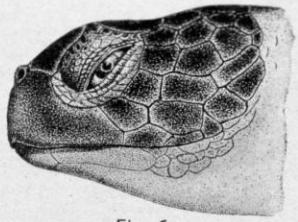


Fig. 6.

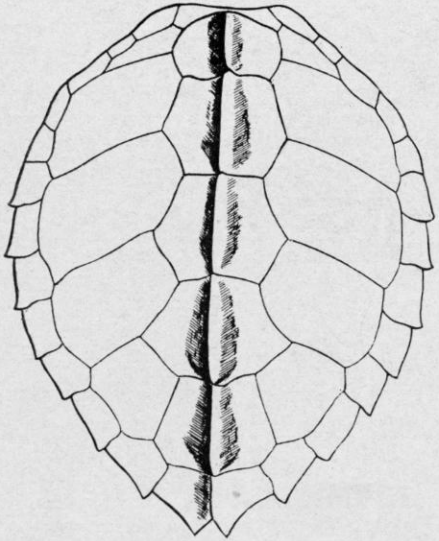


Fig. 1.

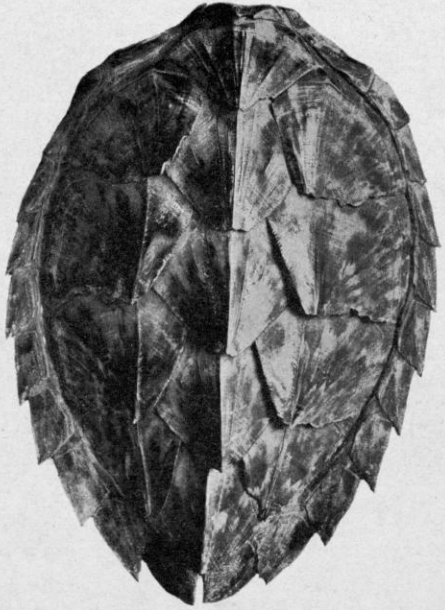


Fig. 3.

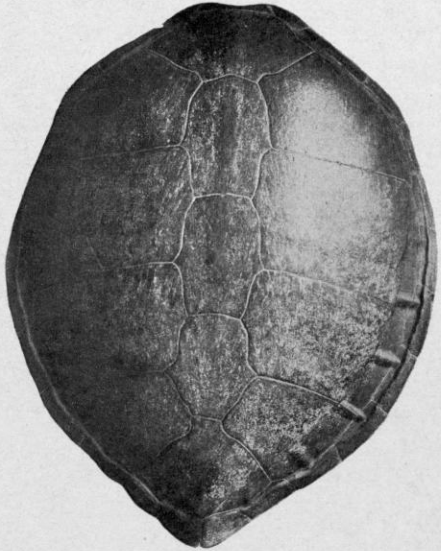


Fig. 5.

PLATE IV.

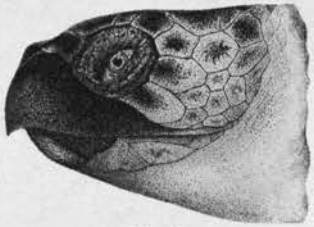


Fig. 2.

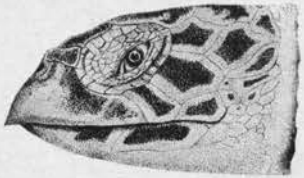


Fig. 4.

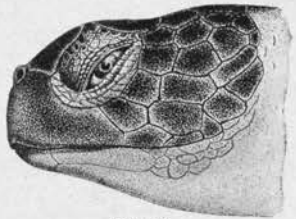
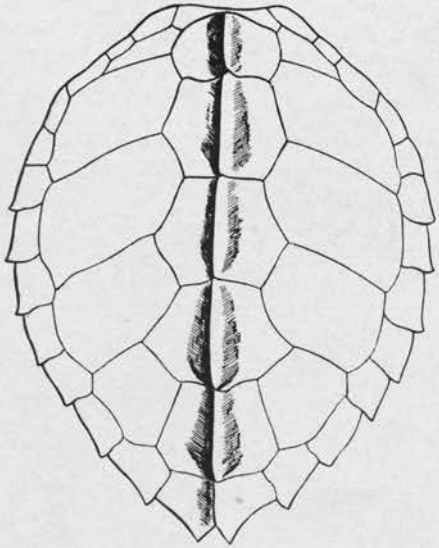


Fig. 6.



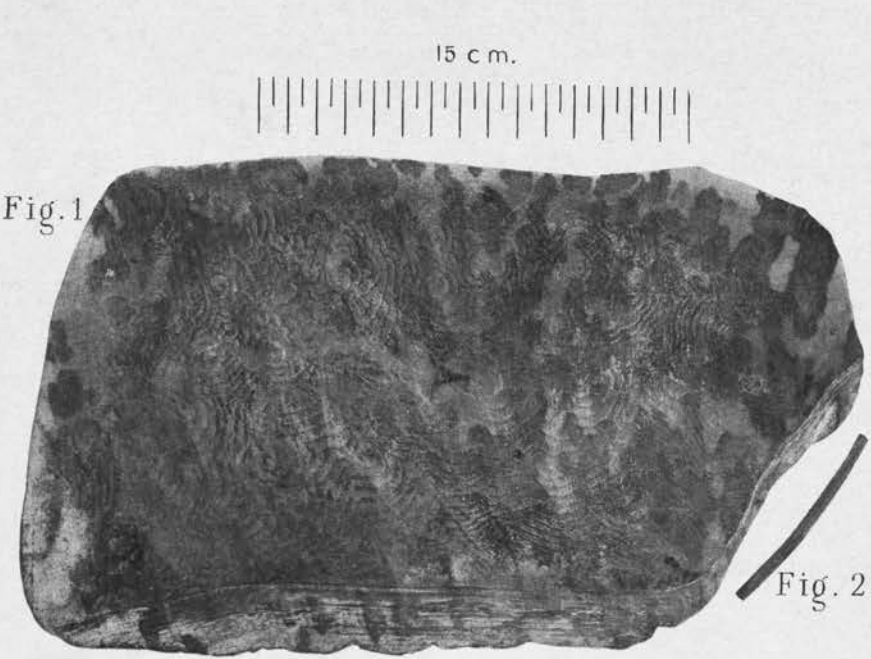


PLATE V.

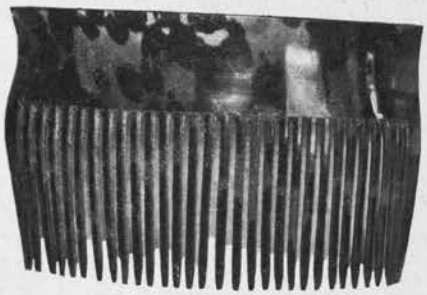


Fig. 1.

Fig. 4.

Fig. 2.

Fig. 5.

Fig. 3.

Fig. 6.

15 cm.

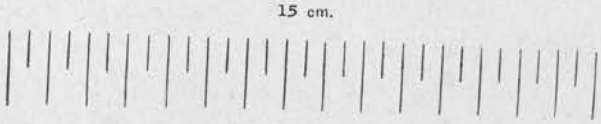


PLATE VI.

Fig. 1

Fig. 2

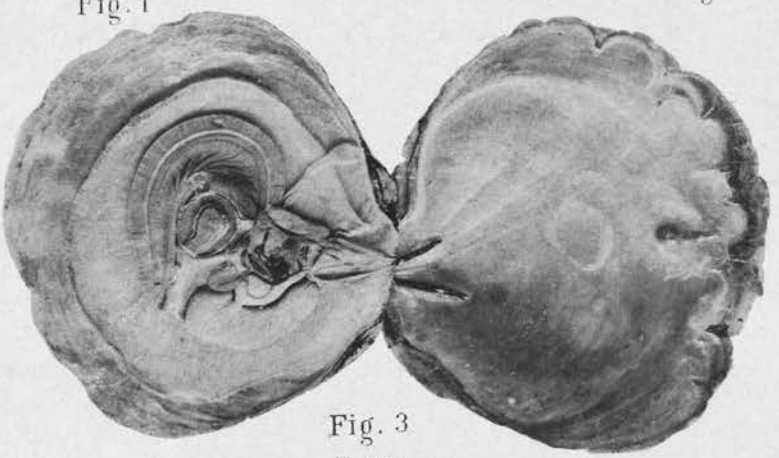


Fig. 3

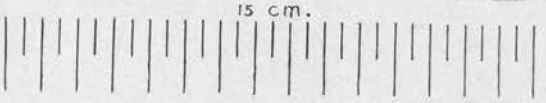


PLATE VII.

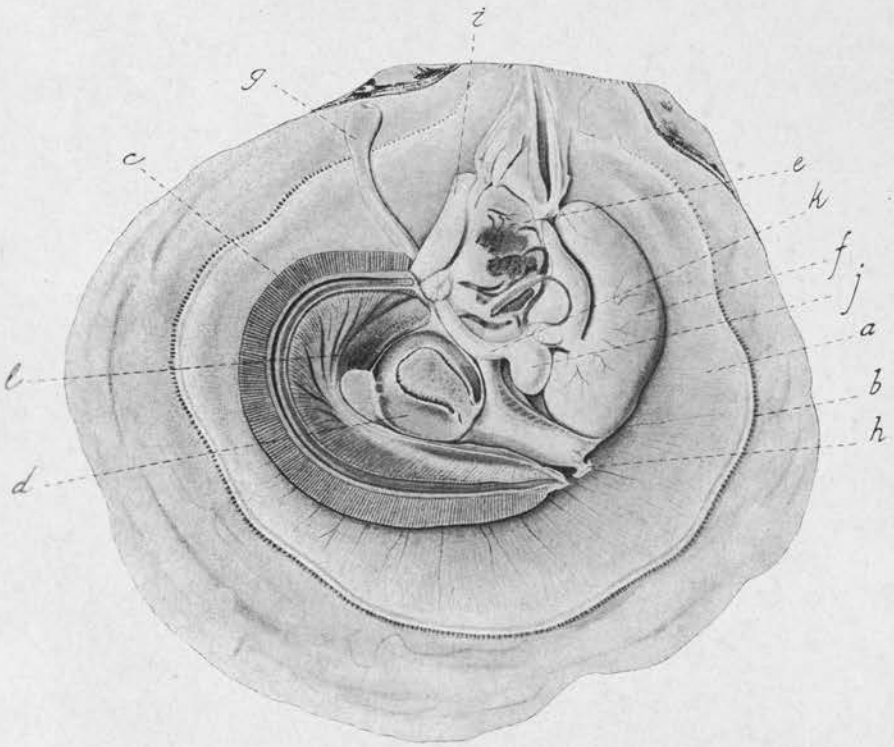


PLATE VIII.

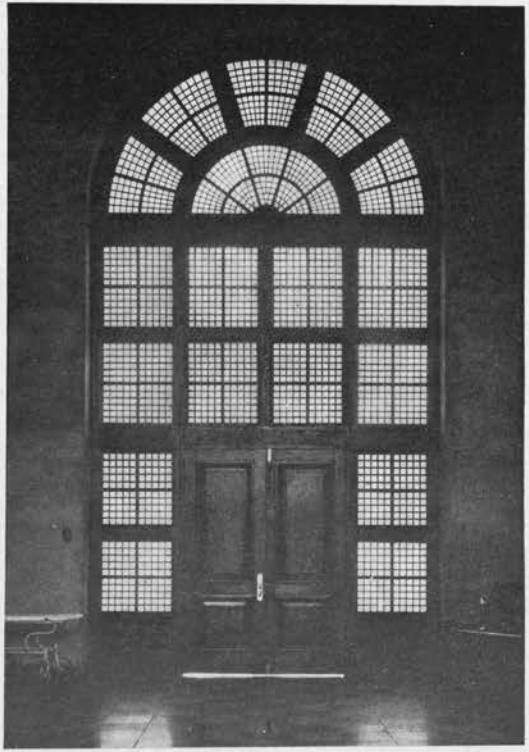


Fig. 1.

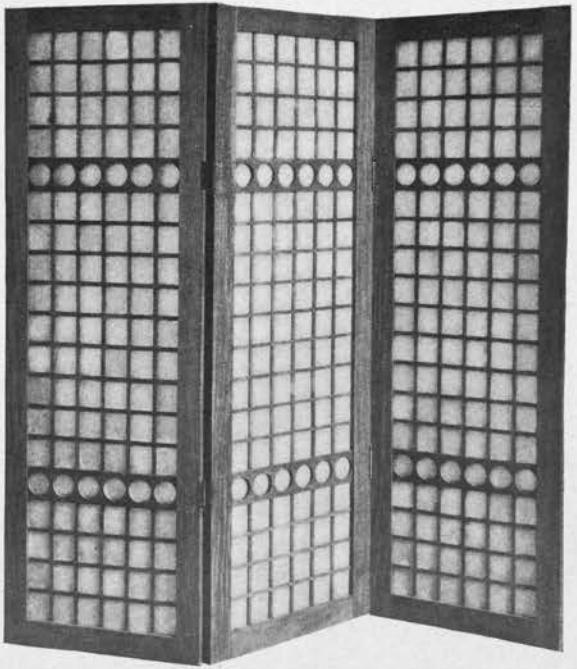


Fig. 2.

PLATE IX.

Fig. 1

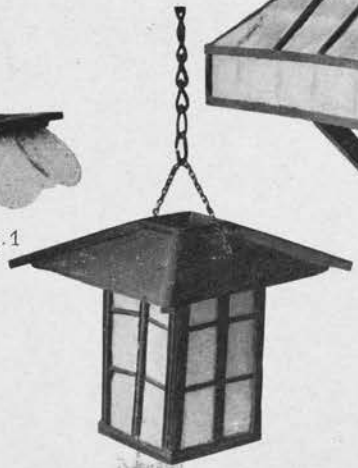


Fig. 2

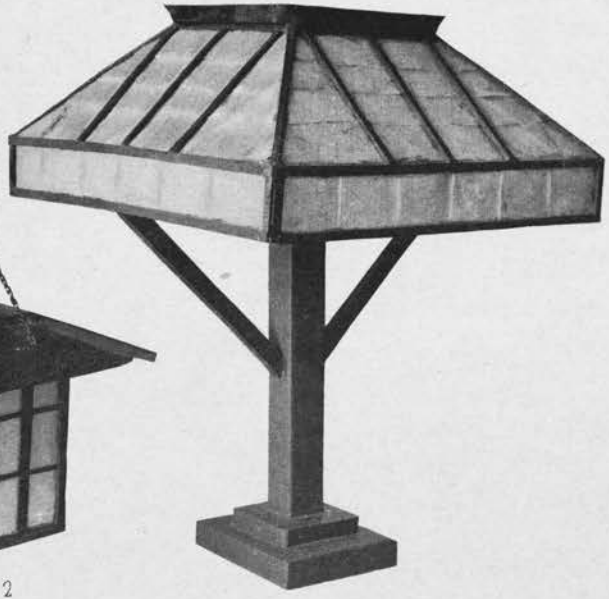


Fig. 3

Fig. 4.

PLATE X.

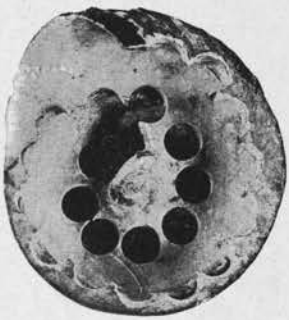
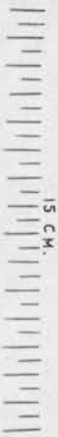


Fig. 1.

Fig. 2.



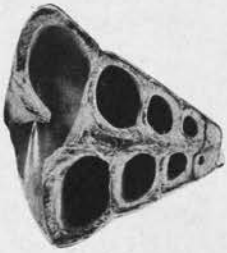


Fig. 3.

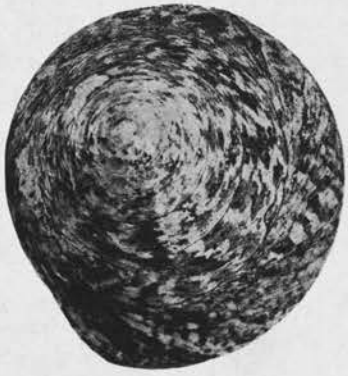


Fig. 4.

PLATE XI.

Fig. 1.

Fig. 2.

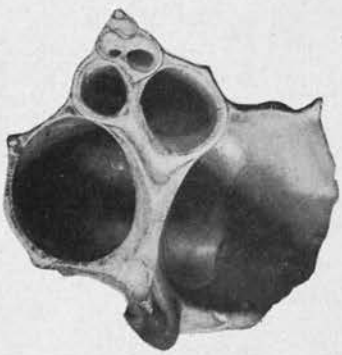


Fig. 3.

Fig. 4.

15 CM.

PLATE XII.

THE PHILIPPINE JOURNAL OF SCIENCE,
D. General Biology, Ethnology and Anthropology.
Vol. VI, No. 6, December, 1911.

THE NON-CHRISTIAN PEOPLE OF AMBOS CAMARINES.

By MERTON L. MILLER.

(From the Division of Ethnology, Bureau of Science, Manila, P. I.)

The Province of Ambos Camarines is occupied mainly by the Bikol people. In the northern part of Camarines Norte there are certain towns which are occupied wholly or in part by Tagalogs. Many of the latter are said to have come in from the north at the time of the discovery of gold at Paracale and neighboring towns. With these exceptions all the municipalities of the province are occupied by Bikols. However in the hills of both Camarines Sur and Camarines Norte there are other people who apparently are neither Tagalog nor Bikol. In Camarines Sur these people know themselves and are known to the Christian population of the towns as "Agta." The great body of them lives on the slopes of the two extinct volcanoes, Iriga and Isarog. They state that in Spanish times white people never ventured among them. Their hostility toward the Spaniards is said to have been due to continual attacks made on them by the latter and to the consequent desire for revenge awakened in the hill people. To all appearances there is no danger whatever in going alone among them at the present time.

Those about Mount Isarog are found for the most part about one-third of the way up the slopes and apparently in about the place where they have lived for years. They formerly were scattered about in the hills, but now are slowly coming to live in groups, although they say they prefer to live scattered about. This is probably partly because they are thus enabled to be nearer to their growing crops and partly because they have been accustomed to this method of life for many years.

The people of Consosep are typical of these groups of Isarog people. Consosep is some six or seven hours travel from Mabatobato, almost all of it uphill. Mabatobato is a *barrio* distant about three and one-half hours from Pili. A schoolhouse is located at Consosep on a spur which juts out from Isarog and is perhaps 610 meters high. The building can be seen for many miles, as the country immediately around it is not wooded. A few hundred yards back of the schoolhouse toward

the mountain are two houses. About the same distance below at a place where the hill is a little less steep is a group of six small houses. Off on another spur, across a deep gulch twenty minutes walk away, can be seen another house. Still others are scattered about in the forest, some near and some several hours' travel away.

The day I was at Consosep about 75 individuals—men, women, and children—came together in response to a call and they were probably not more than one-half or two-thirds of all the people belonging to this settlement. They are a peculiar people. They are not Negritos, although the name by which they are known both among themselves and to others—*Agta*—might indicate that they are. Neither are they typically Malayan. There are, it is true, many among them who do not differ at all in appearance from the ordinary Christian Filipino, but as a rule they are smaller than the average among the latter. They are also darker. Very few of them have straight hair. Some have hair which is almost kinky, while the majority have wavy hair. Some have thick lips and a few the large, noticeable eyes of the typical Negro. (Plate I, figs. 1 and 2; Plate III.)

They dress like most of the other people of the Philippines. The women wear a *camisa* and for a skirt several pieces of cloth wrapped about the body and tucked in at the waist. The men wear trousers reaching to the knees and most of them some kind of a jacket or shirt. However, when working in the fields they wear usually only the loin cloth.

In former times these people lived in rude shelters much like those in which the Negritos still live. Now they dwell in small houses, so small that even they can not stand upright anywhere in them. They are built about 1.5 meters above the ground with floors of bamboo and roofs of leaves.

These people plant upland rice, camotes, maize, taro, squash, bananas, yams, and some few other plants. They have no goats or sheep, but occasionally kill birds to eat.

An old woman with whom I talked who had lived at Consosep all her life said that she did not remember a time when there were Negritos about there. From this as well as from the appearance of the people one would conclude that the Negrito admixture took place many years ago. She also said that formerly they were more numerous than now, that they had been killed by smallpox, cholera, and in fights with the Spaniards, but that they were increasing in number now.

They marry at from 13 to 15 years of age. The old woman above mentioned told me of one woman who had eight children. One man sometimes has as many as three wives, although as a rule they are monogamous. They are said to have a language of their own which has

some Bikol words in it. It may be, however, that this is merely a dialectic variation of Bikol and not a distinct language.

On the Kalawat Islands, which lie a few miles east of Paracale in Camarines Norte, there is a small population most of whom are Bikol, like the people on the mainland opposite, but there are besides the Bikols certain small groups of people known as "Dumagat." They live for the most part in small groups by themselves not far from the Bikol settlements. These people too, like the Agta of Camarines Sur, show evidence of Negrito blood. They are darker than their Bikol neighbors though not noticeably smaller. Some of them have wavy and some curly hair while others have hair as straight as the ordinary Filipino. (Plate I, figs. 3 and 4.)

The Dumagat people of Kaboong Island, one of the Kalawat group, said they came from the mainland. One man was from near Nueva Caceres and looked much like the people about Mount Isarog. They said that they had all been baptized, but the probability is that they are practically non-Christians, as they are remote from any Christian influence. They talk Bikol among themselves, live for the most part scattered about on the hillsides in houses like those of other Filipinos, plant camotes, maize, taro, and yams, but do not plant rice. They had never heard of Negritos living on the Kalawat Islands. They say they call themselves Dumagat because they live near the sea.

I was told that on Butawanan Island off Kinabugsukan Point in Camarines Sur there is a considerable number of these Dumagat people. There are also a few of them scattered among the Bikol people of the coast towns. I did not visit Butawanan and so can not say whether the people of that island resemble the Dumagat of the Kalawat Islands.

There are three possible explanations of the origin both of the Agta people in the vicinity of Mounts Isarog and Iriga, and of the Dumagat of the Islands off the east coast of the province and of the neighboring shores of the mainland. The resemblance between the two groups is sufficiently close to lead one to believe that their origin may be the same.

The first possibility is that they are remnants of an earlier Malayan invasion which preceded that which brought the Bikols and Tagalogs to the Philippines. The second is that they are the result of crossing between an aboriginal Negrito population and their Malayan neighbors. It is furthermore possible that they may be the result of the crossing of some primitive Malayans with Negritos. That there is Negrito blood in them I have no doubt, although this opinion is based only on their physical appearance.

The simplest explanation of the characteristics of these people is that they are the result of crossing many years ago between the Malayan people and Negritos. Occasionally even now men from the low-

lands join these hill people, preferring the life of the latter to that of their fellows in the plains.

The Negritos in Camarines are to be found both in Camarines Sur and Camarines Norte. In Camarines Sur a few Negritos live near Payatan on the slope of Mount Isarog. Here scattered about they dwell in rude shelters in the forests. They work for their Filipino neighbors. They are typical Negritos, apparently without admixture of other blood.

Near the town of Iriga there is a settlement of about 68 people of mixed Negrito and Malayan blood. Some have almost kinky hair and others hair almost straight. I saw no one at this settlement who appeared to be of pure Negrito blood, although in Iriga itself are some 10 or 15 Negritos who are said to be practically slaves and who are not allowed to leave their masters. They do, however, occasionally escape.

In Camarines Norte on the other hand are many pure Negritos, although how many I am unable to say. There is one group near the *barrio* of Batobelani and there is at least one other group near Ragay on the west coast of Camarines. These Negritos do a little farming on their own account, but they more often work for the Christian Filipinos planting and harvesting crops. When they come into the Christian settlements the women and some of the men wear the ordinary Filipino costume. Others of the men wear only the customary loin cloth. The shelters in which they live are often the simplest possible, consisting of a rough floor and a roof of leaves. (Plates II, IV, V.)

It seems to be a rare thing with them to intermarry with the Christian Filipino. All whom I saw in Camarines Norte looked like pure Negritos with no admixture of other blood. In all probability prejudice against marriage with the Negritos has increased with the coming of Christianity. If this be true most of the blending of the Negrito and Filipino blood which has occurred here took place many years ago.

There are probably several hundred Negritos in Camarines Norte. I suspect most of them have come to be dependent to some extent on the Christian Filipinos and, therefore, live near them. They are a mild-mannered, inoffensive people, but I did not see enough of them to learn much about their mode of life.

They are typical Negritos. They are short of stature, have dark skin, closely curled hair, and flat noses. When they are of pure blood there is never any possibility in the Philippines of mistaking them for any other people.

With the exception of the Negritos, the Dumagat people, and those living about Mounts Isarog and Iriga all the other inhabitants of Camarines I believe to be Bikol, with some Tagalogs in the north and a few individuals from other parts of the Philippines scattered about here and there.

ILLUSTRATIONS.

PLATE I.

FIG. 1. Woman of Consosep, Camarines, showing no evidence of Negrito blood.
2. Man of Consosep, Camarines, showing strong evidence of Negrito blood.
3 and 4. Men of Kalawat Islands, Camarines, showing traces of Negrito blood.

PLATE II.

FIGS. 1 and 2. Negrito women, near Ragay, Camarines.
FIG. 3. Negrito man, near Ragay, Camarines.
4. Negrito man, near Batobelani, Camarines.

PLATE III.

FIG. 1. Group of men, near Mount Iriga, Camarines. Some evidently have Negrito blood; others not.
2. Negrito hut near Mount Isarog, Camarines.

PLATE IV.

Group of Negrito men, women, and children; Ragay, Camarines.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

PLATE I.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

PLATE II.

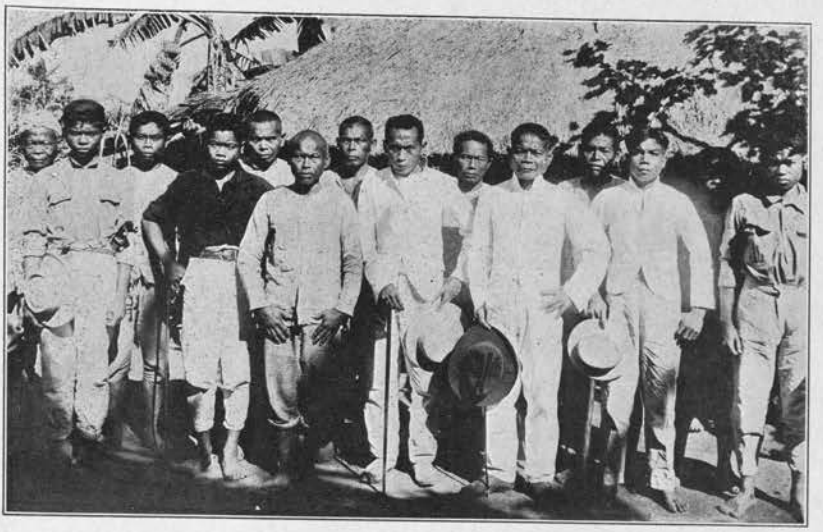


Fig. 1.

Fig. 2.

PLATE III.

PLATE IV.

THE PHILIPPINE JOURNAL OF SCIENCE,
D. General Biology, Ethnology and Anthropology.
Vol. VI, No. 6, December, 1911.

THE STRUCTURE OF THE PALLIAL TENTACLES OF LIMA SPECIES.

By LAWRENCE E. GRIFFIN.[1]

(From the Zoölogical Laboratory, University of the Philippines.)

While turning over stones on a coral reef on the eastern coast of Negros, P. I., there came from under one which I lifted a small *Lima* which went flapping off, like a startled *Pecten*, in a desperate effort to escape. From the edges of the mantle trailed scores of delicate tentacles, from 25 to 60 millimeters in length, of a blood-red color. As quickly as possible I caught the little creature and immediately several dozen of the tentacles fastened to my hand. Many of them clung so tightly that they were broken before letting go.

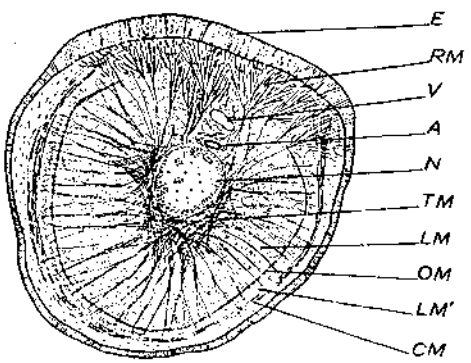


FIG. 1.

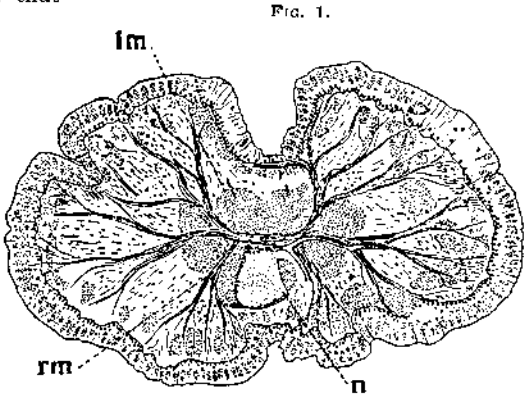


FIG. 2

Each of the tentacles was ringed with annual grooves. These annulations and the great adhesive power of the tentacles, which seemed to be due more to suction than to a mucilaginous secretion, were immediate reminders of the tentacular cirri of *Nautilus*. This first specimen of *Lima* sp. was destroyed by an accident and it was several months before more were found. These were discovered buried at a depth

[1] Associate professor of zoölogy, University of the Philippines, Manila, P. I.

ILLUSTRATIONS.

TEXT FIGURES.

THE PHILIPPINE JOURNAL OF SCIENCE,
D. General Biology, Ethnology and Anthropology.
Vol. VI, No. 6, December, 1911.

BEITRAG ZUR COLEOPTEREN FAUNA DER PHILIPPINEN.

Von J. MOSER.

(Berlin, Germany.)

Holotrichia latecostata sp. nov.

Supra picea, pruinosa, subtus brunnea, nitida, pygidio abdomineque flavis. Capite fortiter subrugoso-punctato clypeo margine antico emarginato; prothorace lato, lateribus medio rotundato-dilatatis, disco sparsim, versus margines laterales paulo densius punctato, linea media laevi, antice abbreviata; scutello remote punctato, medio laevi; elytris, singulo 4-costato, costa prima postice ad suturam versus valde dilatata, subrugoso-punctatis, feminae juxta suturam transversim-plicatis; pygidio haud dense umbilicato-punctato. Subtus medio subtiliter parce punctato, lateribus densius punctatis et flavo-pilosis; tibiis anticis tridentatis, articulo primo tarsorum posticorum secundo aequali.

Long. 16 mill.

Typus No. 11739 in Coll. Ent., Bureau of Science, Manila, P. I.

Hab: PALAWAN, Bacuit (*C. M. Weber*, Collector).

Die Form des Halsschildes, die pruinöse Oberseite und der aufgetriebene gelbe Bauch verweisen die Art in die *mucida*-Gruppe. Der Kopf ist kräftig, fast runzelig punktiert, der Clypeus in der Mitte leicht ausgebuchtet. Die Seiten des Halsschildes sind in der Mitte bogenförmig erweitert, vor den Vorderecken ist der Seitenrand flach ausgebuchtet. Die Oberfläche ist zerstreut mit Nabelpunkten bedeckt, doch stehen die Punkte nach den Seiten zu etwas dichter und sind gröber. Eine punktfreie Mittellinie ist nur in der hinteren Hälfte zu erkennen. Das Schildchen ist zerstreut punktiert, seine Mitte glatt. Die Flügeldecken sind mässig dicht nabelartig und namentlich beim ♀ etwas runzelig punktiert. In der Mitte neben der Naht zeigen sich beim ♀ Querfalten. Jede Flügeldecke lässt 4 schwache Rippen erkennen, von denen die innerste sich hinten sehr stark nach der Naht zu verbreitert. Während bei dem vorliegenden ♂ die ganze Oberseite der Flügeldecken pruinös ist, sind bei den beiden ♀ die Seiten glänzend. Das Pygidium ist schwach gewölbt

und mässig dicht mit Nabelpunkten bedeckt. Die Unterseite ist mit Ausnahme des gelben Abdomens braun, in der Mitte sehr zerstreut, an den Seiten dichter punktiert und hier behaart. Die behaarten Stellen an den Seiten des Abdomens sind matt. Die Vorderschienen sind in beiden Geschlechtern kräftig dreizähnig, die beiden ersten Glieder der Hintertarsen sind gleich lang. Die Krallen sind an der Basis verbreitert, am Ende ziemlich stark gebogen, der mittlere Zahn ist schwach und etwas nach rückwärts gerichtet.

Protaetia banksi sp. nov.

Viridis, flavo-maculata, supra opaca, subtus nitida. Capite maris subtiliter, feminae grosse punctato, fronte 2- an 4-flavo-maculata, clypeo nitido, marginibus paulo elevatis, margine antico emarginato; prothorace lateribus flavo-marginatis, vitta marginali postice abbreviata, disco flavo-bimaculato; scutello immaculato; elytris obsolete punctato-striatis, juxta scutelli basin atque apicem, prope suturam, apice, juxta margines laterales et inter scutellum et humerum maculis flavis ornatis; pygidio flavo-bivittato, vittis antice furcatis. Subtus pectoris abdominisque lateribus flavo-maculatis; processu mesosternali dilatato, margine antico rotundato; tibiis anticis in utroque sexu tridentatis, mediis et posticis intus flavo-ciliatis.

Long. 17 mill.

Typus No. 6334 in Coll. Ent. Bureau of Science, Manila, P. I.

Hab: Negros Occidental, Bago (*Charles S. Banks*, Collector).

Die Art hat in der Zeichnung Ähnlichkeit mit *venerabilis* Mohn. Sie ist etwas kleiner, die Unterseite ist bei allen vorliegenden Exemplaren grün und auf den Flügeldecken befindet sich unterhalb der Schulter eine schmale gelbe Seitenrandbinde, die bei *venerabilis* fehlt. Auch der Forceps ist anders gebildet wie bei dieser Art. Der Clypeus ist beim ♂ fein, beim ♀ kräftig punktiert, mässig hoch umrandet, der Vorderrand ausgebuchtet. Auf der Stirn befinden sich 2 oder 4 gelbliche Tomentflecken. Das Halsschild lässt infolge der Tomentbekleidung eine Skulptur nicht erkennen. Die Seitenränder sind gelb gesäumt, doch reicht die Seitenrandbinde nicht bis zu den Hinterecken. Auf dem Discus befinden sich 2 rundliche gelbe Makeln. Das Schildchen ist unpunktiert und ungefleckt. Die Schulterblätter haben einen hinteren gelben Rand. Die Flügeldecken lassen nur undeutliche Punktreihen erkennen. Sie sind neben der Naht etwas verflacht, so dass die Naht deutlich hervortritt. Von gelblicheln Makeln befinden sich auf ihnen je einer neben Schildchenbasis und Schildchenspitze, ein rundlicher in der Mitte und ein querer hinter der Mitte neben der Naht, ein kleiner an der Nahtspitze. Neben dem Seitenrande läuft eine schmale Längsbinde unterhalb der Schulter und befinden sich dahinter 4 mehr oder weniger quere Makeln, von denen der letzte neben dem Endbuckel liegt. Ausserdem befinden sich hinter dem Vorderrande noch 2 kleine, hintereinander-

liegende Flecken. Das Pygidium trägt jederseits eine gelbliche Längsbinde, welche sich nach vorn verbreitert und gabelt. Auf der Unterseite sind die Seiten von Brust und Abdomen gelb gemakelt und zwar trägt jedes Abdominalsegment jederseits 2 gelbe Querbinden, die äussere am Hinterrande, die innere am Vorderrande. Der Brustfortsatz ist nach vorn verbreitert, sein Vorderrand ist flach abgerundet, seine Oberfläche fast glatt. Die Vorderschienen sind in beiden Geschlechtern dreizähnig, die Vorderhüften, Schenkel und Schienen sind gelb bewimpert.

Ich widme die Art dem Entdecker derselben, Herrn Charles S. Banks, Entomologist, Bureau of Science in Manila.

INDEX.

(New names are printed in **heavy-faced type**; numbers in *italics* indicate synonyms or references of minor importance.)

C

D

E

F

G

H

P

R

U

V

W

X

Y

Z

Order No. 413.

A MANUAL OF PHILIPPINE SILK CULTURE.

By CHARLES S. BANKS.

(Publication of the Bureau of Science.)

Paper, $0.75 United States currency, postpaid.

A Manual of Philippine Silk Culture is a practical guide to the cultivation of the silkworm in the Tropics. It is based upon several years of experimental work in the actual production of commercial silk in the Philippine Islands. The book is generously illustrated with plates showing the stages of development of the silkworm, apparatus used in rearing the silkworm and spinning the silk, and working plans of a model silk-house.

Order No. 415.

PHILIPPINE HATS.

By C. B. ROBINSON.

(Reprinted from Section C, Philippine Journal of Science, Vol. VI, No. 2.)

Price, $0.50 United States currency, postpaid.

The work covers the whole field of the subject, the origin and history of hat making so far as the Philippines are concerned, the materials used, methods of preparation, the actual hats and the difference between them, their prices, statistics of the export trade, brief comparisons with the products of other countries in the eastern Tropics, and the commercial situation and outlook. It embodies also short notes on mat making and other allied industries.

NOTE.—Orders should be sent to the Business Manager, Philippine Journal of Science, Manila, or to any of the below-listed agents. Please give Order Number.

FOREIGN AGENTS.

The Macmillan Company, 64–66 Fifth Avenue, New York City, U. S. A.
Messrs. Wm. Wesley & Son, 28 Essex Street, Strand, London, W. C., England.
Mr. Martinus Nijhoff, Nobelstraat 18, The Hague, Holland.
Messrs. Mayer & Müller, Prinz Louis Ferdinandstrasse 2, Berlin, N. W., Germany.
Messrs. Kelley & Walsh, Limited, 32 Raffles Place, Singapore, Straits Settlements.
Messrs. A. M. & J. Ferguson, 19 Baillie Street, Colombo, Ceylon.

CIRCULARS AND DESCRIPTIVE MATTER SENT ON APPLICATION.

Order No. 413.

THE SUGAR INDUSTRY IN THE ISLAND OF NEGROS.

By HERBERT S. WALKER.

145 pages, 10 photographic plates, and 1 map.

Price $1.25 United States currency, postpaid.

ABSTRACT OF CONTENTS.

NOTE.—Orders should be sent to the Business Manager, Philippine Journal of Science, Manila, or to any of the below-listed agents. Please give Order Number.

FOREIGN AGENTS.

The Macmillan Company, 64–66 Fifth Avenue, New York City, U. S. A.
Messrs. Wm. Wesley & Son, 28 Essex Street, Strand, London, W. C., England.
Mr. Martinus Nijhoff, Nobelstraat 18, The Hague, Holland.
Messrs. Mayer & Müller, Prinz Louis Ferdinandstrasse 2, Berlin, N. W., Germany.
Messrs. Kelley & Walsh, Limited, 32 Raffles Place, Singapore, Straits Settlements.
Messrs. A. M. & J. Ferguson, 19 Baillie Street, Colombo, Ceylon.

CIRCULARS AND DESCRIPTIVE MATTER SENT ON APPLICATION.

Order No. 411.

INDO-MALAYAN WOODS.

By FRED W. FOXWORTHY.

(Being Section C, No. 4, Vol. IV, of the Philippine Journal of Science.)

182 pages, 9 photographic plates.

Price $0.50 United States currency, postpaid.

TABLE OF CONTENTS.

This valuable work is interesting both from the standpoint of commercial and scientific importance. As will be seen from the Table of Contents, the work treats exhaustively of the known Indo-Malayan woods.

NOTE.—Orders should be sent to the Business Manager, Philippine Journal of Science, Manila, or to any of the below-listed agents. **Please give Order Number.**

FOREIGN AGENTS.

The Macmillan Company, 64-66 Fifth Avenue, New York City, U. S. A.
Messrs. Wm. Wesley & Son, 28 Essex Street, Strand, London, W. C., England.
Mr. Martinus Nijhoff, Nobelstraat 18, The Hague, Holland.
Messrs. Mayer & Müller, Prinz Louis Ferdinandstrasse 2, Berlin, N. W., Germany.
Messrs. Kelley & Walsh, Limited, 32 Raffles Place, Singapore, Straits Settlements.
Messrs. A. M. & J. Ferguson, 19 Baillie Street, Colombo, Ceylon.

CIRCULARS AND DESCRIPTIVE MATTER SENT ON APPLICATION.

Order No. 407.

THE BATAN DIALECT AS A MEMBER OF THE PHILIPPINE GROUP OF LANGUAGES.

By OTTO SCHEERER.

TOGETHER WITH

"F" AND "V" IN PHILIPPINE LANGUAGES.

By CARLOS EVERETT CONANT.

141 pages.

Price $0.80 United States currency, postpaid.

Order No. 408.

A VOCABULARY OF THE IGOROT LANGUAGE AS SPOKEN BY THE BONTOC IGOROTS.

By WALTER CLAYTON CLAPP.

Igorot-English and English-Igorot.

80 pages.

Price $0.75 United States currency, postpaid.

Order No. 102.

A MANUAL OF PHILIPPINE BIRDS.

By RICHARD MCGREGOR.

Part I—412 pages
Part II—324 pages } In two volumes.

Descriptions of all known species of Philippine birds, together with keys to species and genera.

Price (for the 2 volumes)$4 United States currency, postpaid.

NOTE.—Orders should be sent to the Business Manager, Philippine Journal of Science, Manila, or to any of the below-listed agents. Please give Order Number.

FOREIGN AGENTS.

The Macmillan Company, 64–66 Fifth Avenue, New York City, U. S. A.
Messrs. Wm. Wesley & Son, 28 Essex Street, Strand, London, W. C., England.
Mr. Martinus Nijhoff, Nobelstraat 18, The Hague, Holland.
Messrs. Mayer & Müller, Prinz Louis Ferdinandstrasse 2, Berlin, N. W., Germany.
Messrs. Kelley & Walsh, Limited, 32 Raffles Place, Singapore, Straits Settlements.
Messrs. A. M. & J. Ferguson, 19 Baillie Street, Colombo, Ceylon.

CIRCULARS AND DESCRIPTIVE MATTER SENT ON APPLICATION.